Memoirs of the Indian Meteorological Department;

BEING

OCCASIONAL DISCUSSIONS AND COMPILATIONS OF METEOROLOGICAL DATA

RELATING TO

INDIA AND THE NEIGHBOURING COUNTRIES.

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UNDER THE DIRECTION OF

GILBERT T. WALKER, M.A., Sc.D., F.R.S.,

DIRECTOR GENERAL OF OBSERVATORIES

VOL. XVIII, PART I.

I.—A DISCUSSION OF THE ANEMOGRAPHIC OBSERVATIONS RECORDED AT RANGOON FROM JUNE 1878 TO OCTOBER 1901.

II.—A DISCUSSION OF THE ANEMOGRAPHIC OBSERVATIONS RECORDED AT CHITTAGONG FROM JUNE 1879 TO DECEMBER 1896

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¶ The Monthly Weather Review is a monthly publication continuously published about four months after the month. Copies of Monthly Weather Review for 1891—97, January 1898, 1899, 1900, 1901, January to May, 1902, and January to November (June excepted), 1903, are out of print.

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I.—*A discussion of the anemographic observations recorded at Rangoon from June 1878 to October 1901, by* Sir John Eliot, M.A., F.R.S., K.C.I.E.

When the meteorological work of observation was imperialised in 1874-75 under the late Mr. Blanford, the first Director-General of the Department, several important series of observations were initiated by him, in the hope they would contribute to the solution of the problems of the diurnal variation of the meteorological elements—but more especially of pressure. One of the most important of these series was the continuous record of the air movement by Beckley automatic anemographs at a number of representative stations. The following gives a list of those stations, together with data as to the commencement and termination (when complete) of the work at these stations:—

Station	Date of commencement of anemograph observation	Date of termination of anemograph observation
Kurrachee		...ber 1894
Dehra Dun	1st August 1875	
Alipore (Calcutta)	1st March 1877	..
Mussooree	6th July 1877	29th December 1888
Rangoon	12th May 1878	31st October 1901
Lucknow	8th July 1878	26th October 1892.
Deesa	16th January 1879	...
Chittagong	21st June 1879	31st December 1896
Roorkee	23rd August 1879	...
Saugor Island	10th February 1880.	...
Belgaum	16th May 1881	...
Nagpur	10th November 1881	31st May 1903
Mormugao	25th June 1883	31st August 1889
Pachmarhi	8th September 1883	15th May 1887
Darjeeling	5th May 1885	31st December 1897
Dhubri	1st March 1889	7th June 1896
Jubbulpore	10th May 1889	30th April 1900
Lahore	7th June 1889	...
Allahabad	2nd September 1890	...
Simla	1st September 1893	27th January 1903
Port Blair	17th August 1894	...
Waltair	16th March 1897	
Cocos Island	16th March 1902	...
Dodabetta	2nd July 1902	..
Poona	10th November 1902	..
Cherat	14th July 1903	.. ...

None of these series of anemographic data has been as yet discussed. Arrangements were made some years ago in the hope that two of the subordinate officers of the Department might take up this work in a series of special investigations, but neither of them was able to give the time that was necessary in order to do the work satisfactorily.

The only discussions on winds published during the reportership of Mr. Blanford were—

(1) The winds of Calcutta. (2) The winds of Benares.

(3) The winds of Kurrachee.

The first and third papers were based on data made over to the Department, and the second was a discussion of the ordinary wind (observations at 10 hrs. and 16 hrs.). A discussion of the wind data of Simla and Darjeeling by myself was published in the India Meteorological Memoirs, Vol. VI. The remaining observational data, for twenty-four stations, have hence been lying for some years unutilised in the archives of the Department. Shortly before my retirement I suggested to my successor, the present Director-General, that if he was unable to make any other satisfactory arrangement in the immediate future, I might be permitted to take up the work of discussing the series in systematic order. The suggestion was accepted and the arrangement approved by Government. The present memoir forms the first of the series devoted to the discussion of the accumulated anemographic data.

The following is the order in which it is proposed to discuss them :—

Station.	Station.
A Series.—Rangoon.	B Series.—Port Blair.
Chittagong.	*C Series.—Kurrachee.*
Saugor Island.	Deesa.
Calcutta (Alipore).	Belgaum.
Allahabad.	Poona.
Lucknow.	Nagpur.
Roorkee.	Pachmarhi.
Lahore.	Jubbulpore.
Mussooree.	D Series.—Dhubri.

My intention in the separate memoirs is to discuss, so far as the data enable, the chief features of the air movement, normal and abnormal, at each of the stations. It is hoped that the discussions may throw some light on the problem of the diurnal oscillation of pressure in India, the chief object for which Mr. Blanford initiated the series of observations. The memoirs preliminary in character will be chiefly devoted to a statement of all the more important features of the air movement and their relations to each other. If time and health permit, they will be followed by a final memoir summarizing the results and deducing general conclusions respecting the more important air movements over India.

Position of the Rangoon observatory, Lat. 16° 46′ N.; Long. 96° 12′ E. Elevation of cups of anemograph above the ground 49 feet 2 inches, and of the barometer cistern 41·2 feet above mean sea-level.

Description of station.—The station is situated on the left bank of the Rangoon river, the eastern deltaic branch of the Irrawadi, and at its junction with the Pegu and Puzundaung rivers. It is 25 miles in a direct line from the sea at the Gulf of Martaban. The town is chiefly built on the alluvial flat above the junction of the Pegu and Rangoon rivers. To the north the ground rises slightly and the dry ferruginous

character of the soil indicates that it is an ancient alluvial deposit. This rising ground culminates in the mound of the Shway Dagon Pagoda, which is, however, in part an artificial accumulation. About a mile further north some rolling ground around a series of small artificial lakes indicates the extremity of the watershed between the Irrawadi and the Sittang rivers. Some miles to the north of the lakes the ground rises to form the extremity of the range of the Pegu Yoma.

The observatory during the period of the observations under discussion was situated at the Rangoon College, a large building on the northern outskirts of the town, surrounded by a grass compound of about four acres in extent, the greater part of which is situated on the north side of the building. The whole of the neighbourhood is densely covered with trees, chiefly of moderate height. The anemograph (a Beckley) was fixed on the ridge of the high pitched roof of the northern extremity of the west wing. The cups of the anemograph were at an elevation of 49 feet 2 inches above the ground level and four feet above the ridge of the roof. The exposure was fairly satisfactory, but there is no doubt that the extensive collegiate buildings and neighbouring trees interfered to some extent with the registration of the wind, more especially of the velocity element.

Chief Geographical features of Burma.—It is necessary in considering the air movement at Rangoon, more especially the annual and diurnal variation, to bear in mind the chief geographical features of the Burmese peninsula. Burma consists of the greater part of the most easterly of the three peninsulas of Southern Asia which project southwards into the Indian ocean and its arms. It differs widely in form and features from the Indian and Arabian peninsulas. Burma proper (excluding the Tenasserim portion of the Malayan Peninsula) consists of two broad valleys or river plains separated by a low hill range and lying between the coast range of the Arakan and Chittagong hills, and the broad plateau district of the Shan States and the Karens.

The coast ranges form a tract of considerable extent and width in the Chittagong and Akyab districts, and reach in the Arakan Yoma to elevations of 7,000 and 8,000 feet. Further south the hill area contracts in width and decreases in elevation, and is not more than 1,000 to 2,000 feet in height in its southern portion. It terminates on the mainland at Cape Negrais but is continued southwards in the detached islands of the Cocos, Andaman, and Nicobar groups. The area including the two river valleys of the Irrawadi and Sittang and the intervening hill range decreases in width northwards from about 200 miles to probably less than a 100 miles in North Burma. These valleys run due north and south and rise very slowly from the coast to the interior. Thus Bhamo, which is about 600 miles in a direct line from the Gulf of Martaban, is only 380 feet above sea level.

The broad plateau area to the east bounding this central river region is of moderate elevation; the greater part of it ranges from 3,000 feet to 6,000 feet. It is of considerable width averaging about 80 miles.

The interior of Burma hence consists of an elongated trough bounded by two elevated and masses, the eastern of which is the more extensive and the western the more elevated. The trough expands at its southern extremity into the deltaic area of the Irrawadi.

The interior is hence fully open to sea winds from the south. These winds penetrate into the distant interior but the general course of the lower air movement in the interior to the north of the deltaic area is determined by the trend of the valleys or trough. Rangoon is situated in the low delta, and hence in a large expanse of open country where the air

movement is undoubtedly determined in part by winds across the southern extremity of the Arakan Yoma, and perhaps, but to a much smaller extent, from the Gulf of Martaban and the low ground of North Tenasserim.

Sketch of the meteorological conditions and the air movement of Burma.—The most important and characteristic division of the year in Burma, as in India, is into the dry season and the wet season.

The dry season lasts from November to April or May, the change from the wet to the dry season usually occurring on the average of the whole of Burma (excluding Tenasserim) in the last fortnight of October. Dry pleasant weather with clear skies and light northerly winds prevails in the beginning of November over Upper and Central Burma. In the rice districts of Lower Burma, the air continues for some time very damp due to the large evaporation from the rice fields at the end of the rains, and the temperature is moderately high. Cool dry weather extends over that area by the end of November or beginning of December, and holds steadily until the end of February. Little or no rain as a rule falls during this period in Burma, except in Upper Burma, where light showers are occasionally received during the later stages of the movement of the cold weather storms of Northern India. Pressure is highest during the period, November to February, in Upper Burma, and the isobars run nearly due east and west. Pressure is about a tenth of an inch higher in Upper Burma than in the North Andaman sea and Tenasserim, and the pressure range is slightly greater in December than in January and November. Light northerly winds with generally a slight westing, prevail in the river valleys of Upper and Central Burma, as in East Bengal and Arakan, and with a slight to moderate easting (increasing in amount southwards) in the plains of Lower Burma and the Andaman sea. This current is of comparatively low elevation, as winds are from southerly directions above the elevation of 3,500 feet in the Shan Hills. Skies are remarkably free from cloud during the period, the mean cloud in Lower and Central Burma being below 1·0. Cyclonic storms giving general moderate to heavy rain, are of very exceptional occurrence. Only three such storms have visited this area during the past twenty years, *viz.*, in December 1895, January 1890, and February 1901. The rainfall accompanying those storms occurred when the rice crop was being harvested, and was hence very inopportune and caused considerable damage and loss.

Temperature is lowest in January in Burma and in December in Tenasserim but differs little during these two months.

The following gives means for five representative stations for the period.—

District	Representative Station	Mean temperature reduced to sea level.		
		November	December.	January.
		°	°	°
Tenasserim	Mergui	78·0	76·0	76·8
Lower Burma	Rangoon	78·4	75·7	74·8
Central Burma, South . .	Thayetmyo	76·6	70·2	68·4
Central Burma, North . . .	Mandalay	76·4	70·0	69·3
Upper Burma	Bhamo	70·2	63·0	62·4

The preceding data indicate that at the coolest time of the year the mean temperature varies between 77° in South Tenasserim and 62·4° in Upper Burma. The diurnal range of temperature is large, increasing from 20° in the coast districts of Lower Burma to 26° in the interior of Central and Upper Burma.

February is a transitional month from the cool weather to the hot season, during which winds shift round to southerly directions in Lower Burma, and temperature commences to increase rapidly. The rise of temperature continues until the end of April in Lower and Central Burma, and until May in Upper Burma.

The following table gives the changes of mean temperature from month to month during the period at the five representative stations :—

Station	Difference of mean temperature of				Total change during period.
	February and January.	March and February.	April and March.	May and April.	
	°	°	°	°	°
Mergui	2·4	2·8	0·5	—0·2	5·5
Rangoon	2·6	3·9	3·8	—2·8	7·5
Thayetmyo	5·3	8·4	6·0	—0·7	19·0
Mandalay	5·0	8·3	7·1	—0·7	19·7
Bhamo	4·9	7·4	6·0	+2·8	21·1

The data indicate that temperature increases from 5° to 10° in the coast districts during the period, and from 10° to 22° in the interior.

The following gives actual mean temperature data :—

Station.	Mean temperature (reduced to sea level).		
	March.	April.	May.
	°	°	°
Mergui	82·0	82·5	82·3
Rangoon	81·3	85·1	82·3
Thayetmyo	82·1	88·1	87·4
Mandalay	82·6	89·7	89·0
Bhamo	74·7	80·7	83·5

The diurnal range of temperature is usually greatest in March, and decreases moderately in amount during the next two months, due in part to increasing cloud amount and in part to the extending influence of the sea winds in the interior. The

following table gives data of the diurnal range of temperature at the five representative stations:—

Station.	Diurnal range of temperature in		
	March.	April.	May.
	°	°	°
Mergui	19·3	18·2	15·3
Rangoon	25·5	22·4	14·6
Thayetmyo	33·3	27·2	20·7
Mandalay	29·8	24·5	20·0
Bhamo	28·9	26·3	21·0

Temperature increases most rapidly during March and April in a portion of the interior defined by the stations of Minbu, Pagan, Yamethin, and Mandalay. Temperature is highest in that area, the excess over that of the neighbouring seas and coast districts being greatest in April when the day temperature averages about 15° above that of the adjacent seas. The night or minimum temperature is slightly lower in March and slightly higher in May in the land than in the sea area. The chief feature of the temperature conditions of the period in Central Burma relative to the neighbouring seas is the large excess of temperature during the day hours, with which is associated an important change of the pressure conditions. Pressure decreases over the whole area, but most rapidly in the dry hot interior, and a local low pressure area forms in Central Burma which is the most important feature in the pressure conditions of Burma during the period. This depression is feebly marked in March but is prominently exhibited in April and May. It is, as might be expected from the temperature conditions, most pronounced and extensive in the afternoon hours. This depression of purely thermal origin determines the air movement in Burma during the period. Winds are on the mean of the period from north-west at Diamond Island, south at the mouth of the Rangoon river, and south-east at Moulmein. They are from southerly directions in the interior of Lower Burma and in Central Burma, and from northerly directions in Upper Burma. The air movement increases steadily during the period in the interior, and is most vigorous in the central districts in the southern quadrant of the depression. The following gives mean data for eight representative stations:—

Station.	Mean air movement per hour.		
	March.	April.	May.
Mergui	2·2	2·3	1·9
Moulmein	3·3	3·9	3·4
Rangoon	4·5	5·6	4·5
Diamond Island	9·3	8·5	7·8
Thayetmyo	4·8	6·5	7·7
Minbu	7·4	9·7	10·3
Mandalay	4·2	6·3	7·4
Bhamo	3·3	4·2	3·1

It is noteworthy that in the coast districts and in Upper Burma the air movement is greater in April than in May, whereas in Central Burma it is greatest in May.

The amount of cloud increases considerably during the period, and is also greater in the day than the night hours, being a maximum in the afternoon. The following gives mean data for five representative stations:—

Station.	Mean cloud amount.		
	March.	April.	May.
Mergui	3·4	4·6	6·3
Rangoon	2·0	3·1	7·0
Thayetmyo	0·6	1·1	5·1
Mandalay	1·3	2·4	4·9
Bhamo	2·2	3·8	5·6

The chief feature in the cloud distribution is the large increase in the month of May accompanying the increasing volume of sea winds blowing across the coast into the interior.

The distribution of the rainfall during the period is similar to that of the amount of cloud, but is even more marked. Showers are of occasional occurrence in March and April and give small total monthly amounts chiefly in the coast and hill districts. General rain is of comparatively frequent occurrence in May, and the whole area receives moderate to heavy rain. The distribution of the rainfall differs considerably from that of East and North Bengal and Assam, but is somewhat similar to that of West Bengal.

The following data for the three areas show the contrast:—

East and North Bengal and Assam.

Representative Stations.	Mean precipitation.		
	March.	April.	May.
	Inches.	Inches.	Inches.
Chittagong	2·14	4·47	9·68
Commilla	2·74	6·27	10·94
Sirajganj	1·26	2·95	7·95
Cooch Bihar	1·66	5·89	15·26
Silchar	7·93	13·56	15·72
Sylhet	6·25	13·92	21·83
Cherra Poonjee	11·08	32·24	51·53
Shillong	1·85	4·29	10·06
Sibsagar	4·74	9·88	11·47

BURMA

Station.	Mean Precipitation		
	March.	April	May.
	Inches.	Inches	Inches
Rangoon	0 16	1'74	11 73
Thayetmyo	0'06	0 81	4 78
Mmbu	0 02	0 52	4 53
Pagan	0 13	0 53	2 84
Mandalay	0 21	1'19	5 26
Maymyo	0 34	2 80	10 39
Bhamo	0 69	1 65	6 15
Myitkyina	0 92	1 75	7 43
Tiddim	1 63	3 03	4'73
Akyab	0 53	1 56	12'24

WEST BENGAL.

Stations.	Mean precipitation.		
	March	April.	May.
	Inches	Inches	Inches.
Saugor Island	1'18	1 06	4'75
Calcutta	1 14	1'54	5'60
Burdwan	1 24	2 20	5'56
Berhampore	1 05	1 75	4 88
Monghyr	0'44	0 50	2'18
Malda	0'82	1'35	3 87

There is hence a marked contrast between the scanty rainfall of March and April in Burma and Arakan (and also West Bengal), and the moderate to heavy rainfall in Assam, North and East Bengal. The contrast is best exhibited by the hill stations of Cherra Poonjee in the Assam hills and Maymyo on the Shan hills, both at about the same elevation of about 4,000 feet. This contrast appears to be chiefly due to the lie of the hills with respect to the low sea current which brings up the aqueous vapour. In Burma the hills run north and south, and hence give rise to comparatively feeble forced ascent, whereas in Assam and North Bengal, they lie east and west transverse to the winds, and hence lead by their obstructive action to vigorous forced ascent with which are associated frequent thunderstorms and hailstorms, occasionally of destructive violence. Thunderstorms are, on the other hand, comparatively rare in Burma. It is only in the month of May that the movement increases in volume or elevation sufficient to give rise to moderate or heavy rain in Burma similar to that of West Bengal, but both largely below that of East Bengal and Assam.

Occasionally in the month of May cyclonic storms form in the Bay of Bengal and pass into Burma. These sometimes form near and to the west or north-west of the Andamans, and pass by a curved path to the Arakan coast. These storms break up on crossing the Arakan Yoma, but the humid south-west winds in their rear pass up the river valleys and give general rain to the interior for some days after the disappearance of the storm as a cyclonic circulation. They appear to form most frequently in the Andaman sea to the east of the Andaman Islands, and pass northwards to the Pegu coast.

The following gives a list and a very brief description of these storms during the period 1879—1901:—

Year.	Month and date.	Details of storm.
1884	May 13th to 17th	Squally rainy weather set in over the south of the Bay on the 9th and 10th. This general disturbance slowly advanced northwards on the 11th, 12th, and [illegible] day being probably in lat. 10° N. was generated. Its centre lay in lat. [illegible] h; in lat. 13° N. and long. 92° E. at [illegible] d long. 90° 45' E at noon of the 16th, and in lat. 19° N. and long 91¾° E. at noon of the 17th. It reached the Arakan coast at 9 P.M. of the 17th and broke up during the night of the 17th. The lowest reading of the barometer observed at Akyab was 28·98".
1890	May 5th to 9th	The storm formed to the east of the Andamans in front of a strong advance of monsoon winds. It adopted an unusual course, advancing northwards throughout the Preparis Channel and then curving eastwards and passing into Burma. It gave a heavy burst of rain to Burma from the 7th to the 12th.
1897	„ 11th to 15th	This storm formed in the North Andaman sea on the 11th and 12th, and marched northwards into Lower Burma on the morning of the 14th and broke up during the day. The storm was feeble throughout.
1899	April 28th to 2nd May	This storm was generated in the Andaman sea. It marched slowly northwards towards the Burma coast, the centre passing over Diamond Island on the 1st, and broke up against the South Arakan Hills before the morning of the 3rd. It was apparently a concentrated disturbance of considerable intensity and occasioned a moderate to heavy burst of rain in Burma.

The rainy or wet season lasts from May or June until October or the beginning of November. It is characterized by more frequent general and heavy rain than the preceding month of May. There is no marked transition or change of meteorological conditions from one period to the other.

Temperature falls slightly at the commencement of the period, and is nearly constant during the next four months. The following gives data for the five representative stations:—

Station.	Mean temperature of month reduced to sea-level.				
	June.	July.	August.	September.	October.
	°	°	°	°	°
Mergui	79·7	78·9	78·8	78·3	79·2
Rangoon	79·6	78·9	78·8	79·2	80·1
Thayetmyo	83·3	82·0	81·9	82·2	81·3
Mandalay	85·9	85·7	85·2	84·0	83·0
Bhamo	82·1	81·2	81·8	81·7	79·1

The mean temperature of the period is about 6° higher in North Central Burma (the area including Pagan, Minbu, Yamethin, and Mandalay) than in the coast districts, and about 3° higher than in the northern districts of Upper Burma. The diurnal range is small, ranging from about 8° in the coast districts to 15° in the interior. The local depression in Central Burma during the hot weather disappears in June.

Pressure is lowest during the rainy season in Upper Burma and gradients are moderate, the isobars running east and west across the country. There is occasionally a tendency in periods of dry weather to the formation of shallow depressions in Central Burma. These are due to the high temperature of the interior relative to the coast districts and their formation is followed sooner or later by the extension of rainfall from the coast to the interior, when the depressions fill up and disappear.

Southerly winds generally prevail during the period in Burma. In the Pegu coast district they range from west-south-west at Diamond Island to south or south-south-east at Moulmein. They are from southerly directions over the interior, but vary in direction to some extent, being modified by the configuration of the land and the lie of the river valleys. The following gives the mean wind directions at 8 A.M. (local time) at seven representative stations for each month from June to October for comparison :—

Station.	Average monthly mean direction of wind at 8 A.M.				
	June.	July.	August.	September	October
	°	°	°	°	°
Port Blair	S 57 W	S 61 W	S 62 W	S 61 W	S 68 W
Diamond Island	S 30 W	S 43 W	S 46 W	S 51 W	N 53 E
Mergui	S 79 W	S 70 W	N 87 W	N 76 W	N 5 E
Rangoon	S 37 W	S 45 W	S 57 W	S 50 W	S 53 E
Thayetmyo	S 6 E	S 7 E	S 10 E	S 20 E	S 37 E
Mandalay	S 1 W	S 5 E	S 1 W	S 3 W	S
Bhamo	N 81 W	N 70 W	N 80 W	N 72 W	N 4 W

The data for Port Blair, Diamond Island, and to a less extent Mergui, indicate the general direction of the air movement over the sea area to the south and south-west of the Pegu coast. It is very constant in direction throughout the period and is approximately from S 60° W. It is slightly more southerly at Rangoon, but at Thayetmyo and Mandalay it is practically due south. Again at Bhamo it is from almost due west, being determined by the lie of the river valley near the great bend of the river below that station.

Skies are more or less densely clouded throughout the period, more especially in the coast districts. The humid currents give almost daily rain in the coast districts, and frequent rain in the interior. The rainfall is least in amount in the broad fairly open relatively hot area in Central Burma, but increases rapidly in amount northwards in the northern districts of Upper Burma, where the river valleys close in, and the hill ranges

obstruct the advance of the monsoon current. The following data illustrate the general character of the rainfall of the period in the different parts of Burma :—

Station.	Mean rainfall of the month of					
	June.	July.	August.	September.	October.	Total of period, June to October.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
Mergui	30·58	30·61	29·31	26·78	12·57	129·85
Tavoy	40·22	46·75	43·73	33·09	9·73	173·52
Moulmein	37·68	44·45	42·74	29·65	7·90	162·42
Rangoon	18·30	21·37	19·65	15·89	7·12	82·33
Thayetmyo	7·05	7·45	7·58	6·81	4·38	33·27
Akyab	49·50	51·81	39·50	23·05	11·39	175·25
Sandoway	49·18	61·78	48·05	24·17	9·81	182·99
Minbu	4·72	3·91	5·11	5·11	3·66	22·51
Mandalay	5·71	3·26	4·16	6·21	4·54	23·88
Pagan	2·95	1·85	2·93	5·63	4·06	17·42
Bhamo	13·35	19·17	16·40	8·79	3·47	61·18
Myitkyina	12·53	19·78	14·18	9·85	5·67	62·01

The data indicate clearly the chief features of the south-west monsoon rainfall in Burma. The precipitation is heaviest in the Tenasserim and Arakan coast districts, where it occurs at the average rate of one to one and a half inches per diem at stations on the coast during the months of June, July, August, and September. It is probably from two or three times as large in amount on the Arakan hills at elevations of 3,000 to 5,000 feet, but there are unfortunately no data available for these hills. The rainfall decreases rapidly in amount on passing from the Pegu coast into the interior northern districts of Central Burma, where the rainfall is only a fifth to a tenth part of that in the coast districts. It thence increases rapidly northwards towards the mountainous country which forms the continuation in Upper Burma of the Himalayan mountains and the Assam hill ranges, where it is as heavy as in Upper Assam. The rainfall is heaviest in the coast districts and in Upper Burma in July. There is a second maximum in Central Burma in September, when the monsoon currents are slowly retreating from Northern India, and are, although weaker, directed more largely than hitherto to North-Eastern India and Burma.

The rainfall diminishes rapidly in October and usually ceases in the first week of November. The precipitation in November frequently accompanies thunderstorms.

The preceding paragraphs furnish a sketch of the general meteorological features of Burma, and hence throw light on the conditions which determine the air movement at Rangoon, representative of the coast rice-growing districts of Pegu.

One of the most important features determining or modifying the air movement due to the general actions is the relation between the temperature of the interior of Burma (*viz.*, the dry hot area of Central Burma) and of the adjacent seas, more especially the Andaman Sea, from which there is unobstructed passage up the large river valleys into the interior.

The following gives the day and night (maximum and minimum) temperature differences between Yamethin and Diamond Island, Mandalay and Diamond Island, and Mandalay and Rangoon:—

Month.	Yamethin *minus* Diamond Island.		Mandalay *minus* Diamond Island.		Mandalay *minus* Rangoon.	
	Maximum	Minimum.	Maximum.	Minimum.	Maximum.	Minimum.
	°	°	°	°	°	°
January	2·2	—16·4	0·1	—15·0	—5·0	—8·2
February	8·3	—11·7	5·7	—12·2	—2·9	—5·8
March	13·5	— 6·9	12·1	— 7·1	1·1	—3·2
April	13·6	— 2·2	13·6	— 0·5	3·7	1·6
May	6·7	— 2·6	10·4	0·2	7·1	1·7
June	6·3	— 1·1	9·4	2·1	8·5	2·2
July	5·7	— 1·0	9·9	2·8	8·9	2·6
August	5·5	— 1·3	9·0	2·0	8·2	1·9
September	6·9	— 1·0	8·0	1·1	7·1	1·0
October	6·0	— 2·9	5·3	— 1·9	4·1	— 0·8
November	3·3	— 8·2	1·2	— 8·0	—0·9	— 5·1
December	1·1	—15·0	—1·6	—12·9	—5·0	—8·0

Yamethin and Mandalay are typical stations of the interior of Burma. The temperature data for Diamond Island represent approximately the conditions of the open sea area of the Gulf of Martaban and Andaman sea, the day temperature being slightly higher and night temperature slightly lower than in the sea area.

The data of Rangoon indicate that it is considerably cooler than the sea area in the cold weather and much warmer in the hot weather, and that the coast districts to a distance of at least 100 miles from the sea have practically the same temperature as the adjacent sea area during the heavy rains of the south-west-monsoon.

The following are the chief inferences from the preceding data:—

(1) During the cool season— from November to January—the mean temperature of the interior is considerably below that of the sea area, very slightly during the day hours, and very largely during the night hours, probably at least 15° on the average of the period.

(2) In the interior of Burma during the hot weather months of April and May the day temperature is largely in excess, and the night temperature practically the same as that of the Andaman sea. The excess of the day temperature in these months and in March averages about 12°.

(3) During the rains the night temperature differs little over the whole land and sea area, and the day temperature is in moderate to considerable excess in the interior by amounts averaging 9° for the driest districts of Central Burma.

The months most typical of these three periods are December, April and July.

The following gives the mean epochs of the maximum and minimum at Rangoon :—

Season.	Minimum.	Maximum.	Typical month.	Minimum.	Maximum.
	H. M.	H. M.		H. M.	H. M.
Cold	5 55	14 10	December . . .	5 45	14 1
Hot	5 30	13 30	April	5 34	13 40
Rainy . . .	4 56	12 45	July	4 25	12 43

The diurnal variation of temperature at Rangoon is in the dry season intermediate in amount between that of the Andaman sea and Central Burma, and is practically the same as that of the Andaman sea in the rains. The following gives data :—

Season.	Rangoon.			Portblair.	Mandalay.
	Mean range of period.	Maximum range of period.		Mean range of period.	Mean range of period.
		Typical month.	Amount.		
	°		°	°	°
Cold	21·8	December . . .	20·0	10·7	25·1
Hot	20·8	April	22·4	12·9	24·8
Rainy	10·2	July . . .	9·5	8·5	16·2

The range is large and varies considerably in amount during the dry season, including the cool and hot periods. It is small in the rains, the amplitude of variation being barely one-third of that in the dry season. Curves will be found in the memoir containing the discussion of the hourly observations recorded at Rangoon showing the diurnal variation of temperature at Rangoon in each month of the year (*vide* Indian Meteorological Memoirs, Vol. IX.)

The changes of the general pressure conditions in Burma from one season to another have been stated in the preceding remarks. An important feature not referred to in that section is the diurnal changes of the pressure relations, accompanying the large diurnal changes of the temperature relations between the Andaman sea and Central Burma. The available data are very scanty and there is no information for the night hours.

The following table gives the differences of pressure between Thayetmyo and Rangoon for the hours 8 A.M., 10 A.M., and 4 P.M., and for Mandalay and Rangoon at 8 A.M. (there being no data for 10 A.M. and 4 P.M. for stations in the northern districts of Central Burma or for North Burma) :—

Month.	Difference of pressure.			
	Rangoon *minus* Thayetmyo.			Rangoon *minus* Mandalay.
	8 A.M.	10 A.M.	4 P.M.	8 A.M.
January	—·017	—·011	·001	—·023
February	·008	·017	·018	·035
March	·027	·022	·037	·036
April	·039	·033	·046	·052

Month.	Difference of sea level pressure.			
	Rangoon *minus* Thayetmyo.			Rangoon *minus* Mandalay.
	8 A.M.	10 A.M.	4 P.M.	8 A.M.
May	·036	·029	·040	·042
June	·047	·044	·061	063
July	·052	·053	·072	·078
August	·045	·049	·064	·066
September	·028	·032	·046	·027
October	·008	·013	·019	·00
November	—·015	—·004	·004	—·039
December	—·027	—·015	—·001	—·054

The most important inferences from the data of the preceding table are as follows:—

(1) There are moderate gradients for northerly winds in the early morning hours of the cold weather season. Gradients decrease during the day, and are very slight at 4 P.M., when pressure is practically uniform over the greater part of the country.

(2) Moderate gradients for southerly winds obtain in Central and South Burma in the hot weather. It is noteworthy that gradients are steeper at 8 A.M. than at 10 A.M., and are only very slightly steeper at 4 P.M. than at 8 A.M.

(3) Moderately steep gradients for southerly winds prevail over Burma in the rainy or wet season, when the gradients due to local thermal conditions are supplemented and increased by those due to the general south-west monsoon conditions in Southern Asia. They are considerably steeper in the afternoon than in the morning hours, probably due only in part to the greater increase of temperature during the day in the interior than in the coast districts. The following July temperature data for representative stations are interesting from this point of view :—

Representative Station.	July.		
	Minimum.	Maximum	Range.
	°	°	°
Mergui	72·5	84·5	12·0
Diamond Island	75·6	84·3	8·7
Rangoon	75·8	85·3	9·5
Thayetmyo	76·3	88·9	12·6
Minbu	77·2	91·3	14·1
Yamethin	74·6	90·0	15·4
Mandalay	78·4	94·2	15·8
Bhamo	75·1	87·8	14·7

Data.—The original data for the present discussion are the traces or curves of a Beckley's anemograph for the period, June 1878 to October 1901 (23½ years). The hourly values were tabulated from the curves and summaries are given in Tables 1 to 6, Appendix A. Table 1 gives the mean air movement for each hour of the day for each month of the year and for the whole year. Tables 2 and 3 give the total number and total mileage of winds recorded under each octant of the compass at every hour of the day in each month for the whole period. Table 4 gives the total mileage of wind recorded under each octant of the compass for each month of the year and for the whole year. Table 5 gives the mean amount of the component air movement in two fixed directions (North and East) for each hour of the day for each month of the year, and Table 6 the components for the mean day of the year, from the observations and also as smoothed by the use of the harmonic formula.

In Plates I to XIV are given curves showing at a glance the chief features of the air movement at Rangoon. The following gives a very brief description of the plates:—

Plates I, II and III give wind roses for each month showing the percentage amount of the wind for each of eight directions, and the proportion of calms. The vectors are drawn proportional to the amount of wind in each direction during the month. The data from which these are prepared will be found in Tables 3 and 2.

Plate IV, Fig. 1, shows the variation of the mean wind direction throughout the year, Figs. 2, 3 and 4 the variation throughout the year of the absolute velocity of the air movement, and of the northerly and easterly components, and Figs. 5 and 6 the diurnal variation of the resultant air movement at each hour of the mean day of the year. Figs. 1 and 2, Plate V, give the variation of the northerly and easterly components of the air movement throughout the mean day of the year, and Fig. 3 the mean diurnal variation of velocity.

Plates VI to X give the mean diurnal variation of the wind for each month of the year. In these curves the vectors drawn from the origin O to the points defined by the hours represent, in direction and in length, the resultant air movement in direction and in amount or velocity at these lines. The vector O A drawn from O to a point A, generally within the curve, represents the mean air movement of the day, and is assumed to be due to the mean or normal general conditions of the month. The radius vector from any point of the curve to the point A represents the mean direction and amount of the resultant movement due to the diurnal variation alone, and hence to the diurnal variation of conditions originating and producing the variation of the air movement. Fig. 5, Plate IV, is prepared in the same manner from the corresponding data for the whole year, and hence represents the diurnal rotation of the air movement on what may be termed the mean day of the year.

The diurnal variation may be considered from another point of view. In this method the variations of the north and east components are given as separates curves. The mean hourly movement for either one of these directions for the whole day represents the mean movement freed from diurnal changes. This with the signs changed is applied as a correction to the hourly values, and the algebrical sum of this and each hourly value gives the residual variation of that element at that hour due to the diurnal changes. These values are plotted in the usual manner, the abscissae representing the hours, and the

ordinates the residual values, or diurnal variation of that component of the air movement. Curves representing the diurnal variation of the north and east components are given for four typical months in Plate XI and for the mean of the year in Plate V.

Plates XII and XIII give the diurnal variation of the air movement (irrespective of direction) for the mean day representative of each month of the year.

Figs. 3, 5 and 7, Plate XIV, give the diurnal variation of the mean absolute velocity of the air movement in four typical months, and Figs. 2, 4, 6 and 8 the variation during the year of the mean temperature and pressure at Rangoon and of the horizontal temperature gradients in Burma.

Annual variation of the air movement at Rangoon.

1. Brief general description.—The winds in the coast plain of Lower Burma, of which Rangoon is representative, are steadily from north-easterly directions during the cool weather period, from November to January. They are the continuation of a drift from the north down the Irawadi and Sittang river valleys of Upper and Central Burma, and feed into the movement from the north-east across the Andaman Sea and Bay of Bengal. They are comparatively feeble, but increase to some extent with the progress of the cold season in Northern India and Burma. It is almost certain that this movement is of comparatively low elevation, not extending above a height of 3,000 feet, and that there is a feeble local return current from the Andaman sea above that elevation.

Temperature begins to increase rapidly in the interior relatively to the sea area to the south in the beginning of February. Feeble local southerly winds set in over the coast district early in the month and gradually increase in force and extend into the interior. The average date of the commencement of these winds at Rangoon is the 3rd of February. Winds are hence very unsteady during the month and on the mean blow during the night hours from northerly directions and during the day from southerly directions at that station The movement during the next three months is determined by the thermal conditions of the interior. South-westerly winds blow with great steadiness during the period and the movement due to the local conditions is as vigorous as that caused by the more general conditions and actions of the south-west monsoon period. General and moderately heavy rain commences to fall in the coast districts in May, but this is a result of the local air circulation accompanying the continued existence of the depression in the hot area of Central Burma and not due to the great south-west monsoon air movement. The local circulations of Burma and Bengal merge into the south-west monsoon movement in the first fortnight of June. The latter movement is first shown in the south of the Bay and presses forward at the rate of 150 to 300 miles per diem, and hence usually extends over the south and centre of the Bay and Burma to the most northerly districts of that province in less than a week. The depression in Central Burma completely disappears with the establishment of the south-west monsoon and southerly winds prevail over the whole area. The winds during the rainy season at Rangoon differ hardly at all in mean direction from those of the preceding hot season, but are on the whole steadier and for some time slightly stronger than in May. They change little in direction or intensity until the month of September, when they commence to show signs of weakness, and also shift towards east. They decrease steadily in strength throughout September and October, and

in the latter month, the southerly winds back from west to east or south, and the easterly element becomes more prominent as the month advances. The south-west monsoon winds usually withdraw from Lower Burma (as indicated by the Rangoon wind data) on the 1st November, and are replaced by light variable or north-east winds which gradually intensify into the winds of the cold weather season. The change occurs within widish limits. It was, for example, very early in 1883 (11th October), 1891 (12th October) and 1881 (19th October), and was late in 1890 (15th November) and 1893 (the 20th November).

ANNUAL VARIATION OF THE MEAN WIND DIRECTION AND STEADINESS.

(*a*) *The cool season* (*November to January*).—The following gives data for the five months October to February (October and February are transitional months of change from southerly to northerly winds and *vice versâ*):—

Month.	Mean direction of wind (irrespective of velocity). A	Mean direction of resultant air movement B	Steadiness.	
			A	B
October	S 28° E	S 48° E	24	30
November	N 72° E	N 63° E	47	65
December	N 44° E	N 38° E	54	71
January	N 20° E	N 23° E	25	46
February	S 43° W	S 43° W	32	28

During the period November to January winds are from north-easterly directions and are fairly steady. On the mean of the period the winds are from N. 45° E. and the direction of the mean air movement is from N. 41°E. and hence almost identical with the mean wind direction. An important feature of the air movement at Rangoon during this period is the decrease of the strength of the easterly element as compared with the northerly element. This is mainly, if not entirely, due to the change of pressure conditions in the Bay, the belt of low pressure being gradually transferred southwards during the period from the centre of the Bay to the Equatorial belt. The change is exhibited by all stations on the east of the Bay, for example:—

Station	Mean wind direction.		
	November.	December.	January.
Moulmein	N 55° E	N 26° E	N 19° E
Bassein	N 56° E	N 31° E	N 3° W
Diamond Island	N 60° E	N 54° E	N 1° W
Cocos Island	N 69° E	N 33° E	N 15° E
Port Blair	N 81° E	N 57° E	N 39° E

The northerly shift at Rangoon, it will be seen, agrees closely in amount with the shift at all these stations, and is certainly due to the general change of pressure condi-

tions over the Bay area during the period, accompanying the continued retreat of the south-west monsoon currents.

It may also be noted that the winds of December agree approximately in mean direction with the mean wind direction of the whole period and that they are most steady. Hence it may be selected as most adequately representing the air movement of the period at Rangoon.

Winds shift to south-west on the mean of the month in February, but the movement is very unsteady during the month due to the frequent changes between northerly and southerly directions. The mean direction of the winds in February is S. 43° W. in which the westerly element is considerably stronger, and the southerly element relatively weaker than in the following three months.

Hot weather (*March to May*).—The following gives data for this period :—

Month.	Mean wind direction.	Mean direction resultant air movement.	Steadiness Percentage.	
			Wind direction.	Air Movement.
March	S 32° W	S 26° W	62	67
April	S 37° W	S 31° W	62	65
May	S 26° W	S 23° W	56	61

There is very little change in the mean wind direction during this period. On the average of the period it is from S. 32° W. and the mean resultant air movement from S. 28° W. Winds are also very steady during this period, and are slightly less variable in March and April than in May.

The following gives data of the steadiness at the three hours of the ordinary observations :—

Hour.	Percentage measure of wind steadiness.		
	March.	April.	May
8 A. M.	68	70	54
10 A. M.	50	51	50
4 P. M.	58	70	67

It is very noteworthy that the winds are so much more variable at 10 A. M. than they are at either 8 A. M. or 4 P. M.

Rainy or wet season (June to October).—The following gives mean data for each month of the period :—

Month.	Mean wind direction.	Mean direction resultant air movement.	Percentage Steadiness	
			Wind Direction	Air Movement.
June	S 28° W	S 23° W	66	75
July	S 36° W	S 34° W	70	76
August	S 44° W	S 41° W	63	71
September	S 27° W	S 24° W	47	55
October	S 28° E	S 48° E	24	30

Winds are during the period June to September from south-westerly directions and are very steady during the first three months. The westerly element increases to some extent in relative importance during that period. In September the commencement of the retreat and decreasing strength and vigour of the south-west monsoon circulation are exhibited at Rangoon by (1) decreasing steadiness of the winds and (2) decrease of the westerly element of the mean direction (and equivalent to an easterly shift of the wind). Similar changes on a larger scale occur in the month of October, with the result that the mean wind direction of that month is S. 28° E and the percentage measure of the mean steadiness is barely a third of that of June, July and August.

The following gives data of the steadiness of the air movement at 8 A. M., 10 A. M. and 4 P. M. of each month of the period :—

Hour of day.	Mean Percentage measure of Steadiness of wind direction.				
	June.	July.	August.	September.	October.
8 A. M.	67	74	61	48	22
10 A. M.	65	64	65	49	40
4 P. M.	75	79	64	57	41

The year.—The mean direction of the winds for the year is S. 25° W. and of the resultant air movement S. 21° W. It is the resultant of an air movement from north-east during the cold weather and from south-west during the remainder of the year. The average total amount of wind per annum which passes over Rangoon as indicated by the College anemograph is 38,416 miles. The resultant air movement is only 12,005 miles or 31 per cent. of the total movement. The southerly component of this movement is 11,216 miles and the westerly compponent 4,281 miles.

The annual variation of the direction and intensity of the air movement is shown by Fig. 1, Plate IV, the vectors of which from the origin O represent the mean direction and resultant air movement per day for each month of the year.

Variation of the velocity of the air movement during the year.—The following table gives data of the mean or average daily movement for each month of the year, and the components of the resultant movement in the north and east directions:—

	Month.	Mean daily air movement.	Mean component,	
			In north direction.	In east direction.
Season, Cool	November	95·9	+28·56	+55·28
	December	113·1	+63·40	+50·32
	January	93·6	+39·73	+16·98
Transitional month	February	91·7	−19·05	−17·61
Hot	March	113·0	−68·45	−32·16
	April	134·9	−75·72	−44·64
	May	109·2	−61·85	−26·12
Wet	June	121·8	−83·52	−36·23
	July	124·9	−79·02	−52·98
	August	105·2	−55·83	−48·75
	September	86·0	−43·17	−19·08
Transitional Month	October	74·3	−14·72	+17·07

The hourly movement for the whole year is 4·5 miles, almost identical with that of Calcutta (4·4 miles per hour) and slightly less than that of Chittagong (4·9 miles).

The annual variation is remarkable in one respect that there are three well defined maxima and minima in the course of the year. There is a maximum in each season, *viz.*, for the months of December, April and July. The corresponding minimum epochs are the final months of each season, *viz.*, February, May and October. The minima at the epochs separating the period of north-east from that of south-west winds are much more pronounced than the minimum in May, the middle of the period of south-west winds.

The following are the only stations in Burma which agree with Rangoon in having three maxima and minima:—

Station.	Month of maxima.	Month of minima.
Moulmein	April, July, Dec.	Feb., May, Oct.
Diamond Island	March, July, Nov.	Jan., May, Oct.

In other words it is a phenomenon common to the stations in the coast districts of Lower Burma. It does not extend to Thayetmyo, Toungoo or Akyab to the north, nor to Port Blair, Tavoy or Mergui to the south, nor is it exhibited at any station in India.

In the interior of Burma the annual variation presents only two maxima and minima as at many stations in Tropical India, and at the lower Tenasserim stations only one, as is the case over nearly the whole of Northern and Central India.

The air movement is absolutely greatest in April, as is also the case at Saugor Island. It decreases slightly in May and increases again to a secondary maximum in July; in this respect also agreeing with Saugor Island and Calcutta, and the majority of stations in Lower Bengal and Burma.

The following table gives the percentage number of calms at Rangoon derived from the examination of the autographic traces of the Beckley's anemograph :—

Month.	Percentage of calms to total hourly wind observations at		
	Rangoon.	Chittagong.	Calcutta.
January	11·6	21·5	25·1
February	6·2	19·2	15·2
March	5·6	11·0	7·8
April	4·3	4·7	2·5
May	7·4	4·1	3·0
June	6·9	1·9	3·6
July	6·6	2·5	4·2
August	9·9	5·5	5·7
September	13·1	12·0	9·9
October	16·2	25·0	20·9
November	14·1	27·3	20·8
December	10·0	23·5	24·9

Calms are less frequent in the dry season and more frequent in the season of southerly winds at Rangoon than at Chittagong and Calcutta. They are most frequent in October (16·2) and least in April (4·3).

The following gives the diurnal distribution of calms in the three months most typical of the three seasons, *viz.*, December, April and July, and also of the three months of transition from each season to the next, *viz.*, February, May, and October :—

Hour.	Diurnal distribution of calms in the month of					
	December.	February.	April.	May.	July.	October.
0	21	6	4	13	12	28
1	18	5	4	15	12	27
2	15	9	6	19	12	29
3	12	10	7	19	13	28
4	12	14	8	19	14	27
5	12	17	11	19	14	26
6	12	21	14	19	15	24
7	9	18	13	11	10	18
8	4	14	5	5	6	9
9	1	5	4	2	2	4
10	0	2	2	1	1	3

Hour	Diurnal distribution of calms in the month of					
	December.	February	April.	May	July	October
11	0	0	2	1	1	1
12	0	1	2	0	1	1
13	0	0	2	0	0	0
14	1	0	1	0	0	1
15	1	0	1	1	1	1
16	1	1	1	1	1	1
17	3	0	2	1	1	4
18	8	0	2	1	2	15
19	13	2	2	2	4	26
20	21	3	2	4	6	29
21	26	7	3	7	9	31
22	30	7	4	8	11	32
23	26	6	4	9	12	32

Diurnal variation of the air movement at Rangoon.

The data for this are given in Table 5, Appendix A. Curves representing the chief features of the variation on the mean of the year will be found in Figs. 5 and 6, Plate IV, and for each month of the year in Plates VI to X.

The figures in the Plates VI to X represent the variation of the wind during the day with respect both to intensity and direction. The movement is referred to origin O, and axes at right angles representing the north and east directions. The radius vector drawn to the point A represents the mean direction and velocity of the air movement for the month, and the radius vector drawn from the point O to any one of the positions defined by the numbers 0, 1, ...to 23, indicate the mean direction and velocity for the month at the hour of the day given by the number. The vector difference between the mean vector and the vector for any hour (that is, the line joining A to the point marked by the hour number) may evidently be regarded as representing the variation of air movement due to the varying conditions throughout the day, which when added to the movement due to the mean conditions give the mean movement at that hour OA.

A reference to the curves will show that they belong to three types, *viz.*:—

(1) cold weather type,
(2) hot weather type, and
(3) rainy or wet season type.

The curves for December, April, and July are fully representative of the three types.

(1) *Cold weather, November to January.*—The representative curves for the months of November to January will be found in Fig. 4, Plate IX, Plate X and Fig. 1, Plate VI. The curves for October and February differ considerably from the three

types, but examination shows that they are transitional forms from one type to the next n order of season.

The figures for the cold weather months are elongated narrow curves, the longer axis of which in each case differs very slightly in direction from that of the corresponding mean air movement of the month.

The following gives a comparison of these directions:—

Month.	Mean Direction.	
	Air movement.	Axis diurnal curve.
	°	°
November	N 63 E	N 52 E
December	N 38 E	N 40 E
January	N 23 E	N 35 E

The axes are slightly inclined to the mean wind direction. The axis of the diurnal curve is less easterly in November, but slightly more easterly in December and January. The axes shift slightly with the season and in the same sense and by similar amounts as the mean wind direction.

The shape of the curves and lie of the axes for the three months indicate that the chief variation is one of intensity in the direction of the mean air direction, and hence that the diurnal variations of meteorological conditions alternately intensify and diminish the air movement in that direction, and that the diurnal actions are due chiefly to variations of pressure and temperature, the gradients for which approximately coincide in direction with the mean gradients. The diurnal action increases the movement above the mean of the day from about 7 A.M. to 2-30 P.M., and produces the greatest effect from 10 A.M. to 11 A.M., when the actual air movement in its diurnal variation is greatest. During the remainder of the day, *i.e.*, from 2-30 P.M. to 7 A.M., the diurnal actions reduce the velocity below its mean daily amount. This effect is greatest from 6 P.M. to 10 P.M., when the movement is nearly constant in amount but changes slightly in direction. Hence the air movement is a minimum during this period of the day. It is least absolutely at 7 P.M. in November and 9 P.M. in December and January. The vectors representing the movement due to the diurnal variation are much longer for the period 6 A.M. to 2-30 P.M., when they are approximately in the same direction as the mean wind direction, than they are for the remaining hours of the day when they are opposite. In other words, the diurnal effect in the direction of the mean winds is much greater than that in the opposite direction.

In addition to this variation in the north-east and south-west directions, there is a slight transverse change of movement. This is from south-east during the period 10 A.M. to about 6 P.M., and from north-west during the remainder of the day.

The combination of these variations along and transverse to the axes gives curves which are described in the direct sense, *i.e.*, clockwise or with the sun.

The diurnal variation of the velocity or amount of the air movement during this period, November to January, is well marked and characteristic.

It is feeblest from 7 P.M. to 10 P.M., and increases slowly during the night from the minimum epoch to 6 A.M. (about sunrise) and rapidly during the next three hours. It is greatest at 10 A.M. and varies very slightly during the next hour, and then decreases more or less rapidly from 11 A.M. until about 6 P.M., and thence slowly to the minimum at about 9 P.M. The variation has hence a single maximum and minimum, the epochs of which differ by several hours from the corresponding epochs of the temperature variation.

The following gives a summary of the more important features of the amount of the air movement for each month :—

Month	Velocity				Ratio, amplitude to mean.	Epochs	
	Mean.	Maximum.	Minimum	Amplitude		Maximum.	Minimum
						A.M.	P.M.
November . .	4·00	7·06	1·58	5·48	1·37	9 to 10	7 to 8
December . .	4·71	8·27	2·70	5·57	1·18	9 to 10	8 to 9
January . .	3·90	6·80	2·12	4·68	1·20	9 to 10	8 to 9

In the following is given a summary of the chief features of the diurnal variation of the air movement and also of the accompanying changes of pressure, temperature and aqueous vapour at Rangoon during the period :—

(1) From 6 A.M. to 10 A.M.—Rapid increase of the northerly and easterly components of movement, and hence of the resultant or total velocity in the direction of the mean movement, with the result that the velocity is absolutely greatest at the end of this period, *viz.*, from 9 to 10 A.M. During this period pressure increases at Rangoon, but the mean pressure gradients decrease slightly over Central and Lower Burma owing to smaller rise of pressure in the interior. Temperature increases rapidly, the maximum rate of increase occuring between 8 A.M. and 10 A.M. As the temperature increases somewhat more rapidly in the interior than in the coast districts the temperature gradients from north to south (*i.e.*, from the cool interior to the warmer coast and sea districts) diminish slowly. The amount of aqueous vapour present in the air increases about 10 per cent. of the mean amount present in the air during this period

(2) From 10 A.M. to 2 P.M.—During this period, the northerly and easterly components of the air movement decrease rapidly, with the result that at about 2-30 P.M. the movement differs little in either amount or direction from the mean of the day (the direction being slightly more easterly than the mean). Temperature increases during this period more or less rapidly up to the maximum at about 2 P.M. As it increases more rapidly in the interior than in the coast districts, the temperature gradients decrease during this period and are probably least from 2 P.M. to 3 P.M. The amount of aqueous vapour present in the air decreases during this period to a minimum at about 2-30 P.M. The decrease is small in November and December but moderate in amount in January (about 12½ per cent. of the mean value).

(3) From 2 P.M. to 6 P.M.—Continued decrease of the northerly and easterly components of the air movement which are during this period and during the night up to 6 A.M. below their mean value for the whole day. This is hence equivalent to the superimposition of southerly and westerly movements upon the mean movement. This action attains its maximum at about 6 P.M. During this period temperature is decreasing rapidly, the rate of decrease being greatest from 5 P.M. to 6 P.M. Also as the rate of decrease is greater in the interior than the coast districts the temperature gradients (from north to south) commence to increase. The amount of aqueous vapour present in the air, as measured by its pressure, increases during this period by nearly the same amount as it decreased from 10 A.M. to 2 P.M.

(4) From 6 P.M. to 10 P.M.—Slight increase of the northerly component and decrease of the easterly component, so that the mean movement for the period is slightly less easterly during the preceding period and increases slightly in amount. The changes both of velocity and direction are very small during the period and suggest that the gradients and actions are practically unchanged. Temperature decreases slowly and the gradients increase slightly during the period. Pressure increases up to the secondary maximum of the day.

(5) From 10 P.M. to 3-30 A.M. or 4 A.M.—Slow but steady increase of the northerly and easterly components, so that at the end of the period the movement as at 2·30 P.M. differs very slightly from the mean. The velocity is practically the same, but the direction of the resultant movement is slightly less easterly. Temperature decreases slowly but steadily during the period, and the gradients increase. Pressure decreases moderately during the period to the morning minimum in its diurnal oscillation.

(6) From 3-30 A.M. to 6 A.M.—The northerly and easterly components (during this as in the previous period negative in sign relative to their mean diurnal values) continue to increase slowly in amount as during the preceding interval. During this period temperature continues to decrease until about 6 A.M. when the minimum temperature of the day is usually registered. Pressure increases slightly during the period and the amount of aqueous vapour, on the other hand, diminishes very slightly. There is a marked increase of cloud during this period, following a period from 8 P.M. of nearly constant amount on the average of each month of the period.

The hot weather period, March to May.—The transition from north-east to south-west winds is fully completed in the month of February and during the next three months the mean winds for every hour of the day are from some direction between south-by-east and west.

The curves representing the diurnal variation are given in Fig. 3, Plate VI, and Figs. 1 and 2, Plate VII. They are elongated oval figures, but are not so narrow as, and are also larger than the cold weather curves, indicating that the variation is larger in actual amount than in the cold weather. The chief point of difference between the curves for the cold and hot weather months is that the axes of the curves make a considerable angle with the mean wind direction.

The following gives the mean directions of the axes of the curves for the three months and a comparison with the mean wind directions :—

Month.	Mean direction of axis.	Mean wind direction	Angle
March	S 23° E	S 26° W	49°
April	S 25° E	S 31° W	56°
May	S 7° W nearly due S	S 23° W	16°

The following remarks refer chiefly to the March and April curves, as the May variation is intermediate between that of April and June.

The mean wind direction at 6 A.M. is approximately from west-south-west and the diurnal movement additional to the mean of the day is from north. There is very little change in either of these features during the next four hours; the curves for the two months exhibit a peculiar projection, differing considerably in form for the two months.

The northerly diurnal component decreases rather quickly from 10 A.M. to 2 P.M. when it is *nil* and changes sign and the westerly element of the air movement slowly diminishes, as the diurnal variation during this period has a feeble but increasing easterly component. At 2 P.M., the resultant movement is very approximately equal to the mean of the day, but is somewhat less westerly in direction, being from S 12° W.

From 2 P.M. to 6 P.M. the southerly component increases rapidly, and attains its greatest value at the latter hour. This hour is also the epoch of the greatest velocity irrespective of direction during the day. The easterly component increases from 2 P.M. to 4 P.M. and thence decreases slightly until 6 P.M. The mean wind direction at 4 P.M. is S. 10° E. in March and S. 5° E. in April.

The southerly component decreases rapidly from 6 P.M. to midnight, and the westerly element increases. The change in the southerly component occurs most rapidly in the earlier hours of the period, whereas that of the westerly component is most rapid in the later hours. At the end of this period the southerly component is *nil* and changes sign.

From midnight to 6 A.M., the northerly component of the movement increases but the changes occur more slowly than in the previous stage, as is the general rule for the night hours.

The westerly component, on the other hand, decreases and is *nil* at the end of the period. The diurnal changes of the air movement may hence be considered as due to a movement from the north from about midnight to 2 P.M, and from south during the remainder of the day, and to a movement from the east from about 10 A.M to 6 or 7 P.M, and from west during the remainder of the day, superimposed on the mean movement due to the general conditions of the period. This is seen by a glance at the curves Figs. 1 and 2, Plate XI, showing the variation of the northerly and easterly components on the mean day of the month of April. The diurnal alternating movement in the north-south direction is similar in general character and epoch to that of the preceding season but in the east-west direction differs by four hours in epoch although agreeing in form of variation. The alternating diurnal movements are superimposed on mean movements from

opposite directions in the two periods. In both seasons the diurnal curves are described in the same sense. They, however, differ in this that the upper part of the curves defined by an east and west line through the extremity of the radius vector representing the mean movement is the largest portion of the cold weather curves, whereas the lower half is the larger part of the hot weather curves.

It may be noted that the period of least change of direction or velocity is from 6 to 10 P.M. in the cold weather and from 6 to 10 A.M. in the hot weather.

The variation of the easterly component during the day in the hot weather period is in part at least due to the presence of the low pressure area in Central Burma during the period, and to its intensification and displacement during the day. The changes due to the diurnal conditions are the same in character as in the cold weather and rainy season, but are, as might be anticipated, much larger in amount.

The curve in Fig. 1 of Plate XI shows that the residual movement from north has two maxima, the epochs of which (5 A.M. and 9 A.M.) agree with the single maximum epoch of the rainy season (5 A.M.) and of the cold weather (9 A.M.).

The following gives data of the diurnal variation of the velocity of the movement :—

Month.	Velocity.				Percentage of amplitude to mean.	Epoch.	
	Mean.	Maximum.	Minimum.	Amplitude or change		Maximum	Minimum.
March . . .	4·71	8·46	1·81	6·65	1·41	6 P.M.	7 A.M.
April . . .	5·62	10·09	2·95	7·14	1·27	6 P.M.	6 A.M.
May . . .	4·55	7·40	2·59	4·81	1·06	5 P.M.	6 A.M.

The mean velocity is not large in amount, even in this season. It is a maximum in April, when it is somewhat higher than in the month of July, representative of the south-west monsoon. In this respect the coast stations of Lower Burma agree with those of Bengal, showing that the greatest air movements in these areas are due to local hot weather and not to general south-west monsoon conditions.

This feature, it may be noted, is in no case exhibited on the west coast of India, and is hence peculiar to the weaker of the two branches of the monsoon circulation.

The amplitude of the diurnal variation of velocity is large. It is greatest absolutely in April, but relatively to the mean in March.

The movement is feeblest about sunrise, and hence shortly after the minimum temperature of the day. It increases rapidly from about 7 A.M. to 9 A.M., more slowly until noon, and thence almost as rapidly as in the period from 7 to 9 A.M. during the afternoon hours. The movement is absolutely greatest between 6 and 7 P.M. or about four hours after the maximum day temperature. The retardation of the epoch of maximum velocity with respect to that of greatest day temperature is hence about four hours, practically the same as the acceleration in the cold weather. The velocity decreases rapidly from 6 P.M. to 10 P.M., and thence more slowly during the night hours until 6 A.M., when it is a minimum.

The following is a summary of the chief features of the diurnal variation of the air movement of the hot weather period and of the accompanying changes of air pressure, temperature and aqueous vapour pressure:—

1st.—From 2 A.M. to 6 A.M. At 2 A.M. the movement is practically equal to the mean but is more westerly than the mean (S. 60° W.). The northerly component of the diurnal rotation increases, and the westerly decreases, the latter is practically zero at 6 A.M. During this period temperature is slowly decreasing to the minimum of the day. Pressure decreases slightly until 4 A.M. and then increases slightly.

2nd.—From 6 A.M. to 10 A.M. During this interval the changes of the air movement are very irregular. Thus in March the tracing point of the curve moves from 6 A M. to 7 A M. in the same direction as during the previous four hours, but from 7 to 9 A.M. it is in the opposite direction. During this period the air pressure and temperature and also the aqueous vapour pressure increase. Temperature increases most rapidly between 8 A.M. and 10 A.M.

3rd.—From 10 A.M. to 2 P.M. The northerly element of the diurnal rotation decreases during the period, and is zero at about 2 P.M., whilst the easterly element increases slowly from zero. At 2 P M. the movement differs little from the mean of the day in amount and is less westerly. Temperature increases rapidly until about 2 P.M., when it is a maximum at Rangoon and when the difference between the temperature of the interior and coast is large and probably the maximum of the day. The air pressure and the amount of aqueous vapour present in the air decrease during the interval. The latter (aqueous vapour pressure) is a minimum at about 2 P.M., the hottest hour of the day.

4th.—2 P.M to 6 P.M. The southerly element of the diurnal rotation increases rapidly during this period, and is a maximum at 6 P.M. The westerly element increases until 4 P.M. and then diminishes slightly, until 6 P.M. Temperature commences to diminish in its diurnal variation at 2 P.M. and diminishes most rapidly from 4 P.M to 6 P.M. Pressure decreases during the first half of the interval and then increases. The pressure of aqueous vapour increases rather rapidly throughout the period.

5th.—6 P.M. to 2 A.M. The southerly element of the diurnal rotation decreases and vanishes at midnight, and is replaced by a feeble northerly component. The westerly element increases rather rapidly until midnight, when it is large in amount and then begins to decrease slowly. During this interval temperature diminishes and the gradients, from south to north into the interior diminish. Pressure increases during the first half of the interval and then decreases.

The rainy season, June to October.—The curves representing the diurnal rotation of this period will be found in Figs. 1 and 2, Plate VIII, and in Figs. 1 to 3, Plate IX. The curves for the first four months resemble each other and belong to the same type. That for October is a transitional form, presenting features of the cold weather as well as of the rains type.

The curves, like those for the cold weather, are elongated narrow figures the axes of which differ very slightly in direction from the corresponding mean wind directions. The following gives a comparison for the four months, June to September :—

Month.	Mean wind direction.	Mean direction of axes.
	°	°
June	S 23 W	S 20 W
July	S 34 W	S 27 W
August	S 41 W	S 32 W
September	S 24 W	S 18 W

Both directions change slightly from month to month, in the same sense and by nearly the same amounts. They are more westerly from June to August, but in September when the monsoon begins to weaken, the change is in the opposite direction (towards east).

The directions of the axes are throughout less westerly than those of the wind directions, the opposite of the deflection which obtains in the cold weather.

An inspection of the curves at once indicates that the diurnal changes consist primarily and chiefly of an alternate weakening and strengthening of the movement in the mean wind direction. The movement is practically normal in amount at 9 A.M. and 8 P.M. and is less than the mean during the night hours, and greater during the day hours. There is in addition a feeble easterly movement from 8 A.M. to 4 P.M., and a feeble westerly movement during the remainder of the day.

There is little change in the early morning hours from about 1 A.M. to 6 A.M. Thence until 3 P.M. or 4 P.M. both the southerly and westerly components of the air movement increase (most rapidly from 8 A.M. to 10 A.M.). From 4 P.M. to 5 or 6 A.M. these components change in the opposite direction or decrease (rapidly from 4 P.M. to 10 P.M. and slowly from 10 P.M. to 4 A.M.)

July is the month most representative of the period. In Figs. 3 and 4, Plate XI, are given curves representing the component movements of the diurnal rotation in the northerly and easterly directions. It will be noticed that these two curves are similar in form, having the same epochs, but the range of variation in the easterly direction is barely half that in the northerly direction. In Fig. 2, Plate XIV, is given a curve showing the diurnal variation of the actual velocity, and it will be seen that, as might be expected, it agrees in its epochs and other features closely with those of the components. This parallelism in the three curves is of course due to the fact that the diurnal rotation is due to actions and changes differing very slightly in direction throughout the whole day, from the mean wind direction.

The following gives data of the diurnal variation of the velocity :—

Month.	Velocity.					Epochs.	
	Mean.	Maximum.	Minimum.	Amplitude	Ratio, amplitude to mean.	Maximum	Minimum.
June . . .	5·08	8·48	2·72	5·76	1·13	3 P.M.	5 A.M.
July . . .	5·21	8·55	3·04	5·51	1·06	3 P.M.	6 A.M.
August . . .	4·38	7·29	2·49	4·80	1·10	2 P.M.	6 A.M.
September . .	3·58	6·03	1·93	4·10	1·14	4 P.M.	6 A.M.
October . . .	3·09	5·14	1·64	3·50	1·13	1 P.M.	10 P.M.

The movement is slightly greater in July than in June, and thence decreases steadily throughout the remaining months of the monsoon. The ratio of the amplitude of the velocity to the mean movement is nearly constant throughout the period, in this respect agreeing with the temperature range between coast and interior. It is smaller in amount than for the two preceding seasons, and the mean values are approximately in the ratio of the temperature range of the seasons between the interior and coast.

The velocity is least at 6 A.M., when temperature in its diurnal variation has its lowest value. It thence increases rapidly until 2 P.M. and slowly till 3 P.M., when it is greatest, shortly after the maximum temperature of the day is noted.

The velocity diminishes rapidly during the afternoon hours until about 10 P.M. and thence slightly and irregularly during the remainder of the night until 6 A.M.

The following gives a summary of the more important features of the diurnal variation of the air movement at Rangoon during the period, and of the accompanying and probably related elements of temperature, air pressure and aqueous vapour pressure.

First period, 10 P.M. to 6 A.M. The air movement decreases slightly. The northerly and easterly component of the diurnal variations are small but increase slightly during the period to their maximum positive value at 6 A.M. The velocity of the actual air movement is least at that hour. Temperature decreases and the temperature gradients also decrease. The air pressure decreases until about 4 A.M. and afterwards, and aqueous vapour pressure also decreases slightly to 5 P.M.; cloud is also least during this period in its diurnal variation.

Second period, 6 A.M. to 4 P.M. The air movement increases regularly to the maximum of the day about 3 P.M. owing to an equally regular increase of the southerly and westerly components. Pressure increases until 10 A.M. and thence decreases to the absolute minimum of the day at 4 P.M. Temperature increases slightly in the coast districts, but rather rapidly in the interior until about 2 to 3 P.M. and hence the temperature and pressure gradients from the coast to the interior increase during the period. The aqueous vapour pressure at Rangoon increases until 10 A.M. and then falls slowly to 5 P.M. (apparently due to slight convective action). The amount of cloud on the other hand increases and is a maximum from 4 P.M. to 5 P.M.

Third period, from 4 P.M. to 10 A.M. The air movement decreases rather rapidly due to similar decrease in both the southerly and westerly components. Temperature decreases throughout the period, the fall being greatest from 4 P.M. to 5 P.M. Pressure increases continuously through the period but the pressure and temperature gradients between the coast and interior districts diminish. The aqueous vapour pressure increases very slightly whilst cloud exhibits a continuous decrease throughout the period lasting until the minimum of the day at about midnight.

VARIABILITY OF THE AIR MOVEMENT.

The following table gives the mean air movement per day for each of four seasons of the year, and for the whole year, for each year of the period 1879 to 1901. As already stated, the data for the years 1886, 1887, 1890 are not quite satisfactory, the instrument being out of order and under repairs for a part of each of these years. It is also suggested

by the data that the instrument was also slightly more sensitive, or that the frictional resistance was less in the earlier years than afterwards —

Year	Mean diurnal air movement.				
	January and February	March to May	June to September.	October to December	Year.
1879	120·4	141·2	129·3	109·2	125·8
1880	105·6	127·7	125·7	109·7	118·9
1881	113·9	141·5	125·8	107·1	123·1
1882	89·7	121·7	126·8	100·1	112·7
1883	105·5	131·4	136·2	112·8	124·0
1884	110·5	134·2	116·7	97·0	115·1
1885	83·2	99·4?	105·7?	81·4	96·0
1886	83·3	110·8	56·0	98·4	84·9
1887	86·9	117·8	109·9?	77·2	90·7
1888	99·8	145·2	136·5	106·3	125·0
1889	94·8	130·7	108·7	76·9	103·9
1890	46·5?	71·6?	107·0	82·9	82·0
1891	93·2	141·0	111·8	91·5	110·9
1892	89·1	109·1	106·8	96·8	101·9
1893	93·1	110·2	112·2	111·0	108·2
1894	93·8	115·4	102·1	96·5	102·6
1895	94·4	108·4	97·7	106·7	102·1
1896	103·6	127·2	100·5	55·5	96·5
1897	67·8	100·8	100·1	91·3	92·7
1898	101·2	104·8	71·4	54·2	80·4
1899	68·4	119·1	101·4	91·8	97·9
1900	82·7	114·4	109·3	90·3	101·4
1901	101·6	117·5	112·7	77·1?	103·2
Mean	92·6	119·2	109·1	92·5	104·3

The data suggested that the years 1881, 1883, 1888, 1893, and 1901 were years of maximum velocity, and 1886, 1890, and 1898 years of minimum velocity in the twenty-three year period. It is very doubtful whether the data can be accepted as establishing this conclusion.

The following gives the average number of days per month on which winds exceeding 200 miles in 24 hours were registered, on the mean of the twenty-three year period, 1879—1901, and corresponding data for the Chittagong and Calcutta observatories —

Month.	Mean number of days in which total air movement exceeds 200 miles during day.		
	Rangoon.	Chittagong.	Calcutta.
January	0·8	0	0
February	0	0	0·2
March	0	2·7	2·4
April	0·5	7·6	9·9
May	0·7	4·3	10·8
June	1·6	5·1	4·6
July	1·8	6·8	3·4
August	0·6	3·6	2·0
September	0·2	0·6	1·2
October	0·1	0·3	0·2
November	0·4	0·1	0·1
December	1·1	0	0·1
Year	7·9	31·1	34·9

The data indicate that strong winds (as defined by a total movement exceeding 200 miles per diem) are about four times as frequent at Chittagong and Calcutta as at Rangoon. The absence of strong winds appears to be a characteristic feature of Lower Burma as represented by Rangoon.

The following table gives the maximum amount recorded in one hour and in 24 hours for each month of the year during the period, and also the mean or average of the greatest movement in each month of each year for the twenty-four year period:—

Month	Maximum movement registered in 24 hours	Maximum amount registered in one hour.	Mean absolute maximum movement of 23 years.
January	254	19	14·5
February	172	16	11·4
March	198	18	13·4
April	237	24	16·7
May	327	19	16·3
June	307	31	17·3
July	286	20	16·9
August	235	19	15·5
September	280	21	14·5
October	230	15	11·7
November	248	19	13·7
December	253	17	14·3

The data indicate that the strongest winds at Rangoon are experienced in the month of June. A comparison of the data with the corresponding data in the later memoirs will show that strong winds are less frequent and less severe at Rangoon than at Chittagong and Calcutta. In fact a noteworthy feature of the air movement at Rangoon is the comparative absence of storm winds.

The following table gives data showing the distribution of the daily air movement according to strength during each month of the year :—

Month.	Number of days in which the air movement was					
	Under 50 miles.	Between 50 and 100 miles.	Between 100 and 150 miles.	Between 150 and 200 miles.	Between 200 and 250 miles.	Over 250 miles.
January	4·3	16·5	6·2	2·5	0·8	0
February	2·3	15·5	9·7	0·5	0	0
March	1·8	8·3	16·7	2·9	0	0
April	1·2	3·5	14·5	9·2	0·6	0
May	1·9	12·7	10·3	4·1	0·6	0·1
June	2·6	9·7	10·2	5·6	1·3	0·3
July	2·6	10·6	10·5	5·5	1·6	0·2
August	4·2	12·0	9·7	3·4	0·6	0
September	5·7	15·7	6·7	1·4	0·2	0
October	7·9	17·9	4·0	0·6	0·1	0
November	4·4	13·5	8·3	2·9	0·4	0
December	3·4	10·5	10·5	4·4	1·1	0

The data indicate that the air movement is on the average less than 100 miles per diem on more than 15 days of the month in January, February, August, September, October, and November. It ranges between 100 and 150 miles on 17 days in March, and exceeds 150 miles on 10 days in April and 7 days in June and July.

Meteorological Winds.

A comparison of the wind data with the data of the India daily weather reports shows that during the cold weather period or dry season, from November to February, strong winds at Rangoon are rarely, if ever, due to cyclonic storms. They invariably accompany stronger gradients for northerly winds than usual, and hence usually follow the establishment of high pressure conditions in Northern India after the passage of cold weather storms.

The following gives the chief facts relating to the winds exceeding 200 miles in 24 hours during the period 1879 to 1901 :—

Year.	Month and day.	Amount in day	Maximum in one hour.	Epoch of maximum.
1879	November 1st	238	16	10 to 11 A.M
1882	„ 17th	213	12	8 to 9 „
1883	„ 12th	248	16	8 to 9 „
	„ 13th	237	19	10 to 11 „
1886	„ 19th	209	14	1 to 2 P.M.
1895	„ 29th	218	13	11 to noon.
1897	„ 19th	238	17	7 to 9 A.M
1879	December 28th	209	15	9 to 10 „
	„ 29th	206	18	9 to 10 „
1881	„ 5th	205	17	8 to 9 „
	„ 26th	253	17	11 to noon
1883	„ 28th	214	13	9 to 10 A.M.
	„ 29th	226	15	3 to 4 „
1884	„ 4th	204	13	1 to 2 „
1885	„ 11th	234	16	11 P.M to midnight.
	„ 12th	221	15	Midnight to 1 A.M.
	„ 15th	212	13	9 to 10 A.M.
1888	„ 11th	201	16	8 to 9 „
	„ 19th	230	17	9 to 10 P.M.
	„ 21st	206	12	3 to 4 A.M
	„ 26th	201	14	6 to 7 „
1893	„ 21st	247	16	11 to noon
	„ 22nd	202	14	2 to 3 A.M.
	„ 28th	238	13	3 to 4 „
	„ 29th	203	14	9 to 10 „
	„ 30th	236	16	9 to 10 „
1894	„ 30th	219	14	2 to 3 „
	„ 31st	243	14	6 to 7 „
1895	„ 25th	204	14	9 to 10 „
	„ 26th	246	16	9 to 10 „
	„ 27th	203	13	9 to 10 „
1896	„ 15th	220	15	10 to 11 „
1899	January 4th	211	14	6 to 7 „
1880	„ 26th	216	15	10 to 11 „

Year.	Month and day.	Amount in day.	Maximum in one hour.	Epoch of maximum.
1881	January 22nd	229	16	9 to 10 A.M.
1883	„ 10th	201	11	4 to 5 „
	„ 26th	205	15	Midnight to 1 A.M.
1884	„ 16th	232	15	8 to 9 A.M.
1886	„ 8th	229	13	8 to 9 „
	„ 9th	254	16	8 to 9 „
1894	„ 14th	203	12	9 to 10 „
1896	„ 5th	214	14	8 to 9 „
	„ 6th	221	15	9 to 10 „
1898	„ 11th	209	18	10 to 11 „
	„ 12th	220	16	11 A.M. to noon.
1901	„ 13th	243	17	8 to 9 A.M.
	„ 14th	207	12	Midnight to 1 A.M.

The following is a summary :—

Month interval.	Number of days on which wind amount exceeded 200 miles.	Mean daily amount during these periods.	Mean maximum hourly amount.	Absolute maximum hourly amount.
November	7	229	15·3	19
December	25	219	14·8	18
January	15	220	14·6	18
February	*Nil*			
Total or mean	47	223	14·9	18·3

The maximum amount of wind in one hour was recorded between 9 and 10 A.M. on 13 days, between 8 and 9 A.M. on 10 days, and between 10 and 11 A.M. on 5 days. On only two days was the maximum recorded in the afternoon or evening.

A comparison with the mean curves showing the daily variation of the air movement indicates that it was on the 47 days of these strong winds the same in general character as the normal. The curves in Plates XII and XIII, it may be noted, show that the maximum in these months is normally at 10 A.M. and the minimum from 8 to 10 P.M.

The following gives average amounts of hourly air movement for three periods of strong winds in the cold weather at Rangoon :—

Hour interval.	1893, December 28th to 30th.	1895, December 25th to 27th.	1896, January, 5th and 6th.
0	9	8	10·0
1	11	9	6·5
2	8	8	8·5
3	9	8	9·0
4	10	8	7·5
5	9	5	8·5
6	9	6	8·5
7	9	6	9·5
8	9	8	8·5
9	9	11	12·5
10	14	14	14·0
11	11	11	10·5
12	10	11	11·5
13	9	10	10·5
14	10	10	8·5
15	11	9	8·0
16	10	8	8·0
17	9	7	6·5
18	8	7	7·0
19	8	9	9·5
20	8	10	8·5
21	9	11	6·5
22	9	11	10·5
23	9	11	9·0

The data show that in each of these periods, the maximum air movement occurred between 9 and 10 A.M. The minimum was more variable and there was a tendency to a secondary minimum between 4 and 5 P.M. It is interesting to note that in the cases of these strong winds the day maximum is somewhat earlier and that there is a minimum in the afternoon about 4 P.M. There is also a tendency to a secondary maximum, late in the evening from 9 to midnight, and this may be exaggerated so that in some cases it is the absolute maximum of the day.

The hot weather.—Rangoon was not visited by any cyclonic storm in this season during the period. Two storms advanced from the Bay to the Arakan coast but broke up on the Arakan hills.

Strong winds are of occasional occurrence, due to more vigorous indraught than usual from the Andaman sea to the heated interior of Central Burma. These winds agree in their

general characteristics, more especially in their diurnal variation of strength, with the normal winds of the period as exhibited by the curves in Plate XII.

The following gives comparative data for the periods of the hot weather months of 1879-1901, when winds exceeding 200 miles in 24 hours were registered. The list is not complete due to imperfect records of the instrument caused by the stoppage of the clock and other causes :—

Year.	Date.	Amount of wind on date.	Maximum amount in one hour.	Period of maximum.
April				
1879	2nd	207	14	4 to 5 P.M.
	16th	234	20	6 to 7 A.M.
1880	5th	219	17	10 to 11 „
1881	8th	201	19	5 to 6 P.M.
	9th	214	20	4 to 5 „
	24th	207	15	4 to 6 „
1888	15th	222	13	6 to 7 „
	17th	201	12	9 to 10 A.M.
1889	26th	204	16	5 to 6 P.M.
1896	12th	204	18	5 to 6 „
	17th	237	13	6 to 8 „
1901	18th	202	12	7 to 8 A.M.
May.				
1878	19th	278	20	7 to 8 P.M.
1879	4th	213	12	6 to 7 „
	5th	208	13	7 to 8 „
1881	23rd	210	17	2 to 3 „
1882	23rd	234	16	4 to 5 „
1883	4th	201	16	2 to 6 „
1884	16th	290	17	3 to 4 „
	17th	236	19	5 to 6 A.M.
1885	18th	327	34	4 to 5 „
1890	7th	245	15	4 to 5 P.M.
1891	14th	206	15	5 to 7 „
1895	19th	234	18	1 to 2 „
1897	14th	220	15	1 to 2 „
1898	7th	207	15	2 to 3 „
1899	1st	222	14	11 P.M. to midnight.
	2nd	258	15	Midnight to 1 A.M.

The following gives a summary of the data—

Hour.	Number of days over 200 miles.	Average maximum in 24 hours.	Average maximum in one hour	Absolute maximum in one hour
March	0	0	0	0
April	12	213	15·8	20
May	16	237	16·9	34

The strong winds of the 16th and 17th of May 1884 were due to cyclonic storms, but on the remaining 26 days they were simply intensified hot weather winds. The following table gives average hourly movement for four of these periods, *viz.*, the 8th and 9th April 1881, 17th April 1896, the 4th and 5th May 1879, and the 19th May 1878, all fairly representative of these strong winds —

Hour interval.	1881, April 8th and 9th.	1896, April 17th.	1879, May 4th and 5th	1878, May 19th.	Mean giving equal value to each period.	Normal mean of March and April
0	4·0	11	8·0	4	6·8	4·2
1	7·5	7	10·0	6	7·6	3·9
2	6·5	9	8·0	7	7·6	3·7
3	5·0	8	7·5	5	6·4	3·5
4	5·0	8	7·0	10	7·5	3·3
5	6·5	6	7·5	7	6·8	3·0
6	6·0	9	5·5	11	7·9	2·8
7	4·0	7	5·5	8	6·1	3·0
8	6·0	8	8·0	9	7·8	3·8
9	6·0	10	9·5	10	8·9	4·5
10	6·5	11	10·5	15	10·9	4·2
11	8·5	13	9·5	12	10·9	5·0
12	8·0	8	9·5	15	10·1	5·4
13	8·0	9	7·5	19	10·9	5·7
14	8·5	10	7·0	16	10·4	6·2
15	10·0	11	9·0	13	10·8	6·8
16	17·5	11	8·5	17	13·5	7·6
17	18·5	12	10·0	13	13·4	8·3
18	18·0	11	9·5	17	13·9	8·6
19	16·5	13	12·0	18	14·9	7·5
20	10·0	13	12·0	20	13·8	6·4
21	9·5	9	11·5	15	11·3	5·4
22	6·0	13	10·0	5	8·5	4·7
23	5·5	10	7·5	6	7·3	4·4

The data of the preceding table indicate that on each of the four occasions the air movement during the day varied similarly to that of the normal. The maximum in all cases occurred late in the afternoon between 4 P.M. and 7 P.M., and the minimum generally in the early morning between 5 A.M. and 7 A.M. The hourly means of the four periods follow a law of variation agreeing closely with that of the normal of the period, *i.e.*, the mean of May and April shown by the figures of the last column.

The rainy season.—The data establish that strong winds are of much more frequent occurrence at Rangoon during this season than in the remaining two seasons of the year. Winds exceeding 200 miles in 24 hours were registered on 102 days during this season in the period 1878-1901. The following gives a brief summary of the chief facts relating to these strong winds :—

Year.	Month and date.	Amount of wind on date.	Maximum amount in one hour.	Period of maximum.
1878	June 13th	217	17	1 to 2 P.M.
	„ 22nd	246	18	5 to 6 „
1879	„ 2nd	213	17	2 to 3 „
	„ 7th	204	17	Noon to 1 P.M.
	„ 27th	213	19	2 to 3 P.M.
1881	„ 3rd	307	19	Noon to 1 P.M.
	„ 4th	261	17	7 to 8 A.M.
	„ 5th	210	22	9 to 10 „
	„ 14th	201	15	4 to 5 P.M.
1882	„ 12th	206	15	1 to 2 „
1883	„ 4th	215	16	1 to 2 „
	„ 8th	263	25	Noon to 1 P.M.
	„ 9th	208	18	3 to 4 P.M.
	„ 13th	209	14	1 to 2 „
	„ 26th	254	22	1 to 2 „
	„ 27th	233	18	Noon to 1 P.M.
	„ 28th	205	19	4 to 5 P.M.
1884	„ 19th	203	19	1 to 2 „
1885	„ 18th	273	20	3 to 4 „
	„ 19th	229	16	11 to noon
	„ 20th	238	31	2 to 3 P.M.
1888	„ 10th	210	20	Noon to 1 P.M.
	„ 11th	274	20	3 to 4 P.M.
	„ 17th	253	20	1 to 2 „
	„ 18th	211	13	3 to 4 „
	„ 28th	218	16	Noon to 1 P.M.
	„ 30th	221	18	4 to 5 P.M.

Year.	Month and date.	Amount of wind on date.	Maximum amount in one hour.	Period of maximum
1889	June 14th	219	17	11 to noon
1890	„ 30th	217	17	10 to 11 A.M.
1892	„ 9th	216	18	11 to noon.
1893	„ 25th	220	15	2 to 3 P.M.
1895	„ 17th	206	15	3 to 4 „
	„ 27th	237	18	2 to 3 „
1896	„ 26th	223	18	1 to 2 „
	„ 27th	233	17	11 to noon
1900	„ 25th	208	18	2 to 3 P.M
1901	„ 16th	211	18	5 to 6 „
	„ 17th	210	15	5 to 6 „
1878	July 23rd	234	18	1 to 2 „
1879	„ 3rd	216	15	2 to 3 „
	„ 5th	208	15	Noon to 1 P.M.
1880	„ 8th	214	16	1 to 2 P.M
	„ 14th	262	16	3 to 4 „
1881	„ 12th	222	17	Noon to 1 P.M.
	„ 13th	231	20	3 to 4 P.M.
	„ 14th	225	18	Noon to 1 P.M.
	„ 15th	203	15	2 to 3 P.M.
1882	„ 17th	209	13	1 to 2 „
	„ 18th	219	14	5 to 6 „
	„ 21st	210	15	1 to 2 „
1883	„ 7th	222	18	3 to 4 „
	„ 13th	245	20	3 to 4 „
	„ 22nd	226	19	5 to 6 „
	„ 23rd	238	15	2 to 3 „
	„ 26th	286	17	2 to 3 „
	„ 27th	263	18	2 to 3 „
1885	„ 28th	248	17	Noon to 1 P.M
1888	„ 1st	248	20	3 to 4 P.M.
	„ 12th	210	14	6 to 7 „
	„ 17th	214	17	11 to noon.
	„ 18th	231	18	3 to 4 P.M.
	„ 24th	214	34	8 to 9 „
1889	„ 19th	221	16	2 to 3 „

Year.	Month and date.	Amount of wind on date.	Maximum amount in one hour.	Period of maximum.
1890	July 19th	219	17	1 to 2 P.M.
	„ 20th	203	16	1 to 2 „
	„ 21st	203	17	1 to 2 „
1891	„ 5th	237	20	3 to 4 „
	„ 6th	214	17	1 to 2 „
	„ 31st	261	20	11 to noon.
1892	„ 10th	204	20	3 to 4 P.M.
	„ 17th	214	18	5 to 6 „
	„ 21st	246	14	5 to 6 „
1893	„ 30th	234	20	2 to 3 „
1894	„ 20th	202	13	3 to 4 „
	„ 22nd	206	15	5 to 6 „
1896	„ 21st	211	18	1 to 2 „
	„ 22nd	225	20	1 to 2 „
	„ 27th	222	15	Noon to 1 P.M.
	„ 28th	216	14	7 to 8 A.M.
1900	„ 12th	245	20	3 to 4 P.M.
1878.	August 1st	258	20	2 to 3 „
	„ 2nd	217	16	2 to 3 „
1880	„ 3rd	235	18	1 to 2 „
1881	„ 1st	235	17	2 to 3 „
1882	„ 6th	226	15	Noon to 1 P.M.
	„ 15th	212	16	1 to 2 P.M.
1884	„ 2nd	220	18	Noon to 1 P.M.
	„ 15th	207	18	9 to 10 P.M.
	„ 16th	218	19	2 to 3 „
	„ 17th	213	20	2 to 3 „
1889	„ 17th	214	14	1 to 2 „
1891	„ 1st	203	14	1 to 3 „
1893	„ 4th	211	17	2 to 3 „
1896	„ 12th	223	15	1 to 2 „
1901	„ 8th	218	14	1 to 2 „
	„ 14th	205	15	3 to 4 „
1888	September 13th	202	14	4 to 5 „
	„ 14th	280	21	1 to 2 A.M.

Year.	Month and date	Amount of wind on date.	Maximum amount in one hour.	Period of maximum
1892	September 5th	204	18	3 to 4 P.M.
1893	" 1st	209	14	3 to 4 "
	" 2nd	208	19	3 to 4 "
1899	" 22nd	242	19	11 to noon

The following gives a brief summary of the data :—

Month	Number of days on which wind amount exceeded 200 miles.	Absolute maximum amount in 24 hours.	Mean daily amount during these periods	Absolute maximum hourly amount.	Mean maximum hourly amount
June	38	307	226	31	18 1
July	42	286	226	34	17 4
August	16	258	219	20	16 6
September	6	280	224	21	17 5

Strong winds are hence most frequent in July, the month of greatest mean air movement in this season. They are of rare occurrence in September, the most important example in the twenty-four years being due to a cyclonic storm, the only storm of the rainy season which affected Rangoon appreciably.

The winds in these periods were in fact simply intensified monsoon winds, due to steeper gradients over Burma and North-Eastern India than usual. The winds under these conditions exhibited the diurnal variation normal to the period, having a well defined maximum at 2 to 3 P.M. and a minimum in the early morning about 5 to 6 A.M. The following gives hourly data for five of the periods of strong winds, *viz.*, from the 26th to 28th June 1883, the 18th to 20th June 1885, the 12th to 15th July 1881, the 26th and 27th July 1883, and the 19th to 21st July 1890 :—

Hour	1883. June 26th to 28th	1885 June 18th to 20th	1881 July 12th to 15th	1883 July 26th and 27th.	1890. July 19th to 21st.	Mean of storm periods giving equal weights to each period	Normal mean of June and July
0	6	8	6	11	7	76	34
1	7	7	5	8	6	66	32
2	5	9	7	10	5	72	32
3	4	6	6	9	6	62	30
4	4	8	6	9	7	68	30
5	4	10	6	9	5	68	29
6	4	6	6	10	6	64	30
7	5	7	8	10	6	72	33
8	5	10	6	11	8	80	40

Hour.	1883. June 26th to 28th	1885. June 18th to 20th.	1881 July 12th to 15th.	1883. July 26th and 27th.	1890. July 19th to 21st.	Mean of storm periods giving equal weights to each period	Normal mean of June and July
9	9	10	9	10	7	9·0	4·9
10	12	11	10	11	9	10·6	5·8
11	12	14	14	10	10	12·0	6·5
12	15	14	14	13	11	13·4	7·3
13	15	13	14	15	13	14·0	7·8
14	15	15	12	15	17	14·8	8·4
15	16	19	13	18	12	15·6	8·5
16	17	17	14	16	10	14·8	8·4
17	16	11	13	16	8	12·4	7·6
18	14	14	11	16	9	12·8	6·8
19	14	10	10	8	8	10·0	5·9
20	8	9	10	13	10	10·0	5·2
21	9	7	10	13	10	9·8	4·4
22	8	7	8	11	10	8·8	3·8
23	5	6	6	10	10	7·4	3·5

Concluding Summary.

The preceding is an analysis of the air movement at Rangoon based on the observations and record of a Beckley's anemograph during the 24 years, 1878-1901. The observations were on the whole satisfactorily recorded. The final discussion of the air movement and its connection with the general movement over India and the Bay of Bengal will be undertaken when preliminary discussions of the anemometric data for all stations have been published. The following remarks are made in anticipation of that discussion and it is possible that the inferences stated may require modification to some extent.

Rangoon is remarkable for the comparative lightness of its winds and the absence of storm winds, and compares very favourably in this respect with the other large ports in India, with perhaps the exception of Kurrachee.

The general direction of the air movement in Burma, as in India, is determined primarily by the general temperature and pressure conditions in the large meteorological area including the greater part of Southern Asia, the Indian Seas and Indian Ocean but modified to some extent by local temperature and pressure conditions, and by the physiography of the Burmese area. The general conditions determine the two great phases of the weather or seasons, the north-east and south-west monsoons. The latter or local conditions modify the meteorological conditions to such an extent as to give a movement during a part of the former period of monsoon, similar in most of its features

to that of the latter monsoon. Hence from the anemometric point of view the most suitable division of the year for Rangoon is—

(1) The season of dry northerly land winds from November to February,

(2) The season of damp southerly sea winds from March to October.

February and October are really transitional months presenting to some extent the features of both periods. During the first period (of which December and January are the typical months) temperature in the Burma area is highest in the coast districts and Andaman Sea and pressure is lowest in that region and highest in Upper Burma. The pressure and temperature gradients are moderate, and vary to a moderate extent during the day, but are not reversed by any ordinary diurnal action. Hence the movement is steadily from notherly directions in the Irrawadi Valley. This cold weather current passes over the open Irrawadi Delta of which Rangoon is the representative station and into the Andaman Sea where it becomes part of the general movement from east to north-east across the Bay. The current is hence considerably modified in direction in its passage across the Delta and the Gulf of Martaban and the mean winds at Rangoon during this period have directions between east and north. The mean wind direction changes slightly with the advance of the season owing to the slow changes of the general pressure conditions in the Bay, more especially the seasonal transfer of the monsoon belt of low pressure from the north of the Bay in September to the south in December and its absorption into the equatorial belt about the middle or end of December. Hence the winds at Rangoon become more northerly or less easterly from October to January and also increase in intensity with the increasing gradients over the Burmese area from October to December. In the dry season the diurnal range of temperature is large at Rangoon—nearly as large as in Central and Upper Burma. The minimum night temperature in January is upwards of 15° lower at Bhamo and 8° at Mandalay than at Rangoon where it is 10° lower than at Port Blair. The maximum day temperature is 12° lower at Bhamo and 5° at Mandalay than at Rangoon where it is on the other hand 2° higher than at Port Blair. This relative increase of temperature in the interior accompanies a decrease of the pressure gradients in Lower Burma.

Thus—

Pairs of Stations.	Mean pressure difference in January.	
	8 A M	4 P M
	"	"
Rangoon—Port Blair	·015	·022
Toungoo—Rangoon	·007	·027
Thayetmyo—Rangoon	·017	—·001
Akyab—Rangoon	·025	·050

The data are not quite satisfactory, those of Toungoo and Thayetmyo being especially doubtful; they are however sufficient to indicate that the gradients are not reversed but only

diminished in amount in Lower Burma. These facts indicate that there is a decrease of the air movement in the direction of the mean movement in the day hours and an increase in the night hours. This increase proceeds slowly from 6 P.M. to 6 A.M. when it is supplemented and continued by another action from about sunrise to 10 A.M. During this period temperature increases rapidly (especially from 7 or 8 to 10), and this as its first effect increases pressure. This increase is afterwards relieved by upward and horizontal movement, but for some time the decrease due to this movement is less than the temperature increase. Hence during this interval gradients actually increase as shown below :—

Pairs of stations.	8 A.M.	10 A.M.
	"	"
Rangoon—Port Blair	·045	·049
Toungoo—Rangoon	·007	·022

The special temperature effect ceases very shortly after the period of most rapid increase of temperature and hence the air movement diminishes from about 10 A.M. This decrease goes on rapidly during the period of increasing temperature until 2 P.M. During the next five hours the decrease of temperature and increase of temperature gradients give rise to an effect similar to the corresponding morning increase from 7 A.M. to 10 A.M. In other words the decrease continues until shortly (about an hour) after the period of maximum decrement of temperature when it comes almost abruptly to an end and the ordinary night effect of increasing gradients produces a moderate but steady increase of movement in the usual direction.

In addition to this, there is a variation of movement transversal to the mean wind direction. There is a movement from south-east increasing in amount from about 9 A.M. to noon and decreasing until about 6-30 P.M., and a movement from north-west increasing until 10 P.M. and thence slowly decreasing to 9 A.M. (*vide* curves for December and January). This apparent movement may be either real or mainly represent a positive and negative effect in addition to a mean. It might be the result of an alternating action between the hills and valley of the Irawadi, but as there are broad belts of hills on both sides the effect of one mass would probably be nearly neutralised by the other. It might perhaps be due to an alternating effect between the Tenasserim hills and adjacent low ground and the Gulf of Mertaban. This also appears unlikely to account for more than a small fraction. It might on the other hand be the result of modification at Rangoon of its air movement to the general diurnal changes in the Bay and perhaps Northern India. The westerly movement in Bengal is intensified during the day hours and the movement in the west of the Bay and also the centre (probably), as indicated by Port Blair, is much more directly from the coast. It is probable that the diurnal change at Rangoon may be in part due to these general changes in the centre and east of the Bay.

The hot weather season.—The movement during this period is more complex than in the cold weather and rainy seasons.

The chief features of the movement are fully exhibited by Fig. 4, Plate XII, showing the diurnal variation of velocity, Fig. 1, Plate VII, showing the diurnal rotation and Figs. 1 and 2, Plate XI, the variations of the north and east components of the diurnal rotation for the month of April, representative of the period. The temperature conditions differ very considerably from those of the cold weather.

The following gives data for April:—

Pairs of Stations.	Maximum day variation or difference of temperature.	Maximum night variation or difference of temperature.
	°	°
Port Blair-Rangoon	−6·1	+ 2·6
Rangoon-Mandalay	−3·7	− 1·6
Mandalay-Bhamo	+4·8	+10·2

Central Burma (including the area Mandalay, Pagan, Minbu, Yamethin, etc.) is throughout the period hotter than the coast districts and than the northern districts of Upper Burma. It is significant that Rangoon which is warmer than Port Blair in April by day is cooler by night.

The temperature differences are large and vary very considerably in amount, the gradients being much larger by day than night in Lower Burma and are in fact reversed during the coolest part of the night in the Andaman sea and probably also in the coast districts.

The pressure conditions change from the cold weather type (*i.e.*, decreasing pressure from north to south) to the rainy season type, (*i.e.*, decreasing pressure from south to north) during the period. It is in fact a period of transition and the most important feature of pressure in Burma is determined by the local temperature conditions. Pressure decreases in the central districts relatively to the northern and central districts and there is in April and May on the average a well defined low pressure area lying over the whole of the interior hot area. This varies in extent and intensity during the day and also during the season.

The following gives the mean pressure differences for six pairs of stations at 8, 10 and 16 hours in April:—

Pairs of Stations.	Mean pressure difference in April.		
	8 A.M.	10 A.M.	4 P.M.
	"	"	"
Rangoon-Port Blair	+·001	−·006	−·042
Rangoon-Toungoo	+·018	+·014	+·036
Rangoon-Akyab	+·005	−·009	−·040
Rangoon-Moulmein	−·003	+·003	−·014
Akyab-Toungoo	+·013	+·023	+·176
Rangoon Diamond Island . . .	−·005	−·017	−·052

The preceding data indicate that the depression in the interior, shown chiefly by the Toungoo data at 8 A.M., is greatly intensified and extended southwards during the afternoon. This not only causes a large increase of indraught from the sea during the day hours but a considerable modification of the wind direction in the coast districts. This is shown clearly by the following data:—

Stations.	Normal wind direction in April.		
	8 A.M.	10 A.M.	4 P.M.
	°	°	°
Moulmein	S 34 E	S 48 W	S 60 W
Rangoon	S 61 W	S 60 W	S 5 E
Bassein	N 55 W	N 64 W	N 69 W
Diamond Island	N 47 W	N 53 W	N 63 W
Toungoo	S 28 E	S 19 E	S 13 E
Port Blair	N 82 W	N 63 E	S 63 E
Thayetmyo	S 10 W	S 29 E	S 42 W
Akyab	N 42 E	S 51 W	S 76 W

The winds in the western half of the Delta become more westerly during the day, and in the eastern half more easterly. The shift of wind is similar in character at Moulmein and Akyab and almost certainly represents an alternating action and movement between land and sea and plains and hills. The wind changes during the day in Lower Burma are in accordance with the pressure and temperature changes. The mean air *movement is hence throughout from a southerly direction. The actual movement decreases* steadily during the night hours, and is actually least from one to two hours after sunrise. This appears to be due to a slight increase of pressure due to rapid increase of temperature similar to that which occurs during the corresponding period of the cold weather.

The movement increases up to a maximum at 6 P.M. A reference to the curves, Figs. 1 and 2, Plate XI, indicates that this is due to the southerly and not to the easterly component of the diurnal rotation. The shift in the latter direction due to the displacement of the depression reaches its maximum about 4 P.M. or shortly after the maximum temperature. The greatest variation in the southerly direction is at 6 P.M. In the absence of hourly data for a number of stations in the Burma land and sea, it is not easy to suggest a satisfactory explanation.

So far as can be judged it is an effect similar in general character to that noted as occurring between 6 and 10 A.M., the period of most rapid decrease of temperature. Convective movement is most vigorous in this season, and probably continues for some time after 4 P.M. in the middle atmosphere. Hence the decrease of temperature for a short period gives rise to decrease of pressure which is not compensated by actual compression or condensation of the lower atmosphere. If this be the true explanation, it will evidently also explain the sharp change at 6 P.M. shown in the velocity curve.

It is interesting to note that the periods from 6 to 10 A.M. and from 4 to 6 or 7 P.M. are periods of the day characterized by remarkable relations at Rangoon and that the

peculiar features of the air movement connected with these are most strongly exhibited in the transition period, March to May.

The rainy season.—Southerly winds obtain during the whole 24-hour period. This is due to the facts that the temperature and pressure gradients in Burma are unchanged in general direction during the period, the only variations being of intensity and probably slight shift or change of direction of the gradients.

Temperature is throughout the period greatest in the dry area including Mandalay, Pagan, Minbu, Yamethin. Rangoon is, for example, 8°·4 cooler than Mandalay at the warmest time of the day and 2°·8 at the coolest time. The temperature gradients between these two stations are hence three times as great at about 2 P.M. as at or shortly before sunrise. The maximum day temperature at Bhamo is 6°·4 lower than at Mandalay and the minimum night temperature 3°·3 lower.

There is hence a considerable increase of temperature in the dry area relative to the coast districts and also to the damp districts in Upper Burma.

The pressure data showing the diurnal variations are very limited, but show that gradients from south to north obtain throughout the whole 24-hour period, and that they increase during the day in Central and Lower Burma, but decrease in Upper Burma. It has, however, to be remembered that the day movement is determined in this season not only by the increase of energy due to solar radiation, but also by the addition due to condensation of aqueous vapour which, as shown by the diurnal distribution of cloud, is greatest in the afternoon hours (at Rangoon at 5 P.M.).

As the result of these two actions there will be a considerable increase of velocity in the southern direction during the day hours in Lower and Central Burma and this increase will be a maximum in the afternoon and probably two to three hours after the maximum day temperature (the epoch of which in this season at Rangoon is about 12·45 hours).

The mean direction of the air movement in the open Irawadi Delta as represented by Rangoon is south-west. In July, the typical month for which curves are given in Fig. 2, Plate VIII (showing the diurnal rotation), Figs. 3 and 4, Plate XI (exhibiting the diurnal variation of the northerly and easterly components) and Fig. 1, Plate XIII (giving the variation of the actual air movement), are exhibited fully the more important features of the diurnal variation in this season; further Figs. 3 and 4, Plate XI, show that the epochs of the components are almost identical with each other and the actual velocity, thus in accordance with the conclusion that the variations of gradients producing the variation of the air movement agree closely in direction with those producing the mean movement.

It is noteworthy that the ratio of the maximum to the minimum velocity (3·0 to 8·6 miles) agrees closely with the minimum and maximum difference of temperature between Mandalay and Rangoon, and also that the velocity curve is very similar to that of the temperature gradient curve during the day hours (so far as can be derived from the only available data, which are, however, not quite satisfactory and are hence not given).

It hence follows that the air movement in this season can be explained as the combination of a general air movement due to the general monsoon conditions, and a variable or oscillatory movement due to the local variations of conditions in Burma (resulting from increased temperature in the central relative to the coast and northern districts) which from the physiographical or topographical conditions are chiefly in the same direction as the mean.

The following conclusions appear to follow from the discussion :—

(1) The mean air movement at Rangoon is determined by the general pressure gradients modified by the geographical conditions including its position in the Irawadi Delta; thus it is down the trough formed by the Arakan and Karen and Shan Hills in the cold weather and up in the hot weather and rainy season.

(2) The diurnal rotation is chiefly due to an alternating increase and decrease of movement approximately in the direction of the mean air movement and superimposed upon it.

(3) Throughout the whole year it gives a northerly movement additional to the mean during the night and morning hours, and a southerly movement during the day hours. This explains the most characteristic difference between the diurnal rotation of the dry period of land winds and the period of southerly damp winds, *viz.*, the strong winds during the night and morning hours with maximum velocity at about 9 A.M. and the feeble winds in the afternoon hours of the day period, and the relatively feeble winds during the night hours and strong winds during the afternoon hours with a maximum late in the afternoon of the hot weather and rainy season.

(4) There is also an apparent alternating diurnal movement from the east and west superimposed upon the mean movement, very feebly marked in the cold weather and strongly exhibited in the hot weather. This is, especially in the latter season, probably in part due to an intensification and extension of the hot area in Central Burma and in part to the influence of the strong westerly movement down the Gangetic Plain and across Bengal. This easterly movement chiefly occurs during the night and morning hours, and the westerly movement during the day hours.

(5) Throughout the whole year, the diurnal period from 10 P.M. to 4 A.M. is characterised by comparatively small changes of the direction and amount of the air movement.

(6) During the greater part of the period from 4 A.M. to 10 A.M. temperature, air pressure and aqueous vapour pressure all increase in amount. The air movement increases to some extent, but not to the degree that might be anticipated from the rate of the temperature change, more especially from 8 A.M. to 10 A.M. when it is a maximum. It hence follows that the reduction of pressure due to air movement is not sufficient to compensate for the increase due to temperature in the lowest stratum until about 10 A.M.

(7) From 10 A.M. to 4 P.M. pressure decreases to the minimum of the day throughout the year. Temperature increases to the maximum of the day at about 2 P.M. throughout the whole year. In the cold and hot weathers the variation of the aqueous vapour pressure is inverse to that of temperature and is evidently due to convective action, the air at the higher level containing a smaller amount of vapour relatively to the total air pressure than at the lower level. (This is clearly indicated by the humidity data of Maymyo in the Shan Hills.) In the south-west monsoon, when the air at the higher level contains as large a proportion of aqueous vapour relatively to the total

air pressure as at the lower level, the variation of the aqueous vapour pressure is similar to that of temperature, reaching a maximum shortly after noon.

(8) During the evening hours from 4 P.M. to 10 P.M. temperature decreases slowly but steadily, whilst the air and aqueous vapour pressure both increase to a slight or moderate extent. Convective movements do not cease in the middle atmosphere until shortly before sunset, whilst temperature falls from 4 P.M. to 6 P.M. rapidly, and after that moderately to slightly. This decrease of temperature causes a decrease of pressure not compensated for a short period by increase due to condensations. Hence arise peculiar features of the air movement during this interval, more especially in the hot weather when the maximum movement is at 6 P.M.

TABLE I.—*Mean movement of air irrespective of direction in each hourly interval of each month as registered by a Beckley's anemograph at Rangoon from June 1878 to October 1901.*

HOUR.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	YEAR.
Midnight to 1	2·71	3·49	4·87	4·79	2·93	3·11	3·33	2·80	2·15	1·58	2·87	3·58	3·21
1 to 2	2·79	3·30	4·34	4·60	2·72	2·91	3·38	2·60	2·19	1·83	3·09	3·80	3·15
2 to 3	2·84	2·95	4·02	4·27	2·74	2·78	3·26	2·78	2·00	2·00	3·39	4·08	3·09
3 to 4	2·85	2·54	3·43	3·88	2·67	2·82	3·20	2·51	1·98	2·22	3·54	4·19	2·99
4 to 5	2·85	2·18	2·76	3·38	2·61	2·72	3·08	2·49	1·93	2·22	3·79	4·22	2·85
5 to 6	2·86	1·80	2·06	2·95	2·59	2·81	3·04	2·49	1·93	2·35	3·95	4·29	2·76
6 to 7	3·13	1·80	1·81	3·07	2·92	3·15	3·40	2·73	2·33	2·75	4·38	4·78	3·02
7 to 8	4·16	2·46	2·13	3·90	3·80	3·96	3·99	3·48	2·82	3·57	5·55	6·03	3·82
8 to 9	5·94	3·74	2·85	4·53	4·38	4·94	4·85	4·43	3·63	4·37	6·74	7·68	4·84
9 to 10	6·80	4·47	3·50	4·58	4·76	5·79	5·70	5·08	4·30	4·84	7·06	8·27	5·43
10 to 11	6·80	4·80	3·89	4·83	5·11	6·44	6·53	5·71	4·89	4·99	6·85	7·73	5·71
11 to Noon	6·27	4·83	4·36	5·08	5·67	7·28	7·36	6·45	5·28	5·13	6·56	7·14	5·95
Noon to 13	5·45	4·80	4·74	5·31	6·03	7·81	7·75	6·85	5·58	5·14	5·97	6·26	5·97
13 to 14	5·20	5·06	5·33	5·90	6·45	8·36	8·29	7·29	5·73	5·07	5·43	5·62	6·14
14 to 15	4·86	5·13	5·80	6·71	6·81	8·48	8·55	7·18	5·93	4·68	4·95	5·18	6·16
15 to 16	4·72	5·45	6·66	7·90	7·34	8·38	8·35	7·14	6·03	4·28	4·41	4·99	6·30
16 to 17	4·47	5·52	7·51	9·20	7·40	7·74	7·50	6·25	5·49	3·56	3·19	4·14	6·00
17 to 18	3·74	5·22	8·46	10·09	7·05	6·88	6·76	5·78	4·51	2·56	1·88	3·36	5·52
18 to 19	3·05	4·38	7·64	9·11	5·98	5·92	5·78	4·72	3·82	2·07	1·58	3·11	4·76
19 to 20	2·56	3·87	6·45	7·78	4·99	5·08	5·24	4·06	3·39	1·89	1·72	2·80	4·15
20 to 21	2·12	3·30	5·26	6·57	4·22	4·21	4·48	3·51	2·90	1·73	1·81	2·70	3·57
21 to 22	2·24	3·37	4·98	5·87	3·55	3·69	3·94	3·15	2·60	1·64	2·10	2·82	3·33
22 to 23	2·44	3·54	5·00	5·12	3·33	3·30	3·60	2·78	2·38	1·69	2·35	3·06	3·24
23 to Midnight	2·70	3·67	5·10	5·13	3·14	3·25	3·56	2·73	2·22	1·82	2·73	3·25	3·28
Total daily	93·55	91·67	112·95	134·85	109·18	121·81	124·92	105·19	86·01	74·25	95·89	113·08	105·24
Mean hourly	3·90	3·82	4·71	5·62	4·55	5·08	5·21	4·38	3·58	3·09	4·00	4·71	4·39

TABLE 2.– *Number of winds recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years.*

JANUARY.										FEBRUARY.									
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
0	104	89	30	50	64	68	79	44	119	0	21	9	6	45	136	202	140	33	35
1	108	95	30	40	56	74	78	43	119	1	16	12	10	40	104	200	174	37	31
2	110	106	29	39	45	67	80	41	125	2	14	12	10	29	88	196	182	39	53
3	114	109	29	40	40	63	84	48	115	3	15	11	10	28	77	193	183	45	61
4	110	108	28	33	40	55	87	50	131	4	13	12	11	23	67	174	187	46	89
5	116	110	30	33	36	48	79	55	133	5	16	14	12	23	57	163	183	46	107
6	125	117	32	34	33	45	75	54	123	6	15	19	12	26	53	152	165	43	135
7	128	134	34	33	26	47	68	45	123	7	23	24	16	25	58	142	172	49	111
8	143	168	45	35	22	43	59	53	68	8	41	38	25	28	54	121	162	50	90
9	158	229	54	29	20	36	51	45	17	9	60	77	34	44	58	105	140	69	31
10	158	274	62	27	18	26	30	39	5	10	75	116	60	49	56	81	101	68	12
11	174	280	66	32	17	15	28	30	4	11	98	129	63	67	64	66	72	62	2
Noon	170	263	80	33	15	22	29	37	4	Noon	97	115	68	80	71	67	68	54	4
13	160	217	80	49	31	28	40	46	1	13	89	93	56	90	79	73	76	64	2
14	147	176	80	65	36	38	47	62	2	14	75	64	56	94	99	88	77	68	1
15	150	152	61	69	50	46	58	67	5	15	79	55	39	111	95	87	89	65	3
16	147	151	55	77	47	41	62	65	6	16	78	48	32	124	106	53	86	54	4
17	144	139	51	80	51	42	69	38	18	17	61	39	35	146	132	88	82	42	1
18	136	116	52	87	75	38	76	54	18	18	40	28	24	144	180	83	85	37	3
19	122	107	36	90	87	42	67	45	55	19	30	19	14	119	239	91	68	36	10
20	111	95	33	76	86	39	61	45	104	20	27	17	11	105	253	100	66	29	19
21	98	87	28	60	78	39	59	40	162	21	26	14	8	82	236	127	69	26	41
22	93	80	25	55	70	46	59	39	179	22	22	14	8	63	206	155	89	27	45
23	96	82	30	56	63	60	66	40	154	23	22	11	8	56	157	192	116	30	37
Total	3122	3484	1080	1221	1106	1068	1488	1145	1790	Total	1053	990	628	1641	2725	3039	2832	1128	927
Per cent.	20·0	22·3	7·0	7·9	7·1	6·9	9·6	7·4	11·6	Per cent.	7·1	6·7	4·2	11·0	18·2	20·3	18·9	7·5	6·2

TABLE 2.—*Number of winds recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years.*—contd.

MARCH.										APRIL.									
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm
0	1	1	1	15	150	339	129	8	21	0	7	9	7	11	120	304	137	26	23
1	1	2	1	15	128	320	152	10	26	1	6	7	7	15	95	307	154	28	27
2	1	1	2	12	109	311	168	12	39	2	8	6	7	12	81	309	159	28	35
3	1	2	2	11	101	298	182	13	44	3	8	9	9	9	75	303	162	28	43
4	2	2	1	10	87	284	181	15	72	4	9	11	12	8	76	288	159	29	54
5	4	2	1	10	78	275	175	15	94	5	11	13	8	11	74	279	149	29	71
6	7	2	1	10	76	242	158	21	137	6	13	17	5	11	69	273	145	25	87
7	9	6	2	12	72	241	151	21	138	7	14	15	7	11	68	278	145	25	82
8	13	11	3	13	79	245	167	25	96	8	19	20	10	13	75	295	156	26	31
9	27	16	9	20	102	237	162	37	42	9	22	26	12	14	72	271	165	43	22
10	30	27	19	33	115	213	133	56	24	10	24	26	19	25	84	242	151	62	13
11	29	30	26	81	141	183	103	50	16	11	27	26	19	43	107	228	135	51	10
Noon	33	26	31	91	162	175	88	42	10	Noon	22	21	22	70	125	218	107	51	10
13	26	20	34	105	163	171	90	40	9	13	11	11	32	98	136	197	106	43	11
14	27	15	31	136	168	158	83	33	7	14	17	10	28	125	163	169	96	28	9
15	31	14	29	179	167	123	75	33	6	15	14	7	23	196	176	126	73	24	8
16	23	15	20	229	189	85	64	25	7	16	15	7	15	290	236	102	57	17	8
17	9	9	15	202	289	70	39	19	6	17	7	3	11	144	319	103	45	9	8
18	4	5	3	138	387	73	30	11	7	18	2	3	6	91	370	112	47	9	10
19	1	3	2	80	443	88	23	9	10	19	6	1	4	52	374	144	52	6	11
20	1	2	3	49	434	126	22	9	12	20	5	5	5	31	338	185	59	8	14
21	1	3	2	36	353	201	33	8	20	21	5	6	6	19	256	249	75	14	19
22	2	1	2	28	278	261	55	7	21	22	8	7	6	15	190	272	103	17	25
23	2	2	1	21	201	309	93	8	18	23	10	9	6	11	150	292	117	21	28
Total	285	217	241	1536	4472	5018	2556	527	882	Total	280	275	286	1235	3829	5545	2754	647	662
Per cent.	1·8	1·4	1·5	9·8	28·5	31·9	16·3	3·3	5·6	Per cent.	1·8	1·7	1·8	8·0	24·7	35·8	17·8	4·2	4·3

TABLE 2.—*Number of winds recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years*—contd.

	MAY									JUNE.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W	W.	N.W.	Calm.	Hour.	N.	N.E.	E.	S.E.	S	S W.	W.	N.W.	Calm.
0	14	15	6	36	172	220	92	20	89	0	7	6	4	37	187	250	83	24	93
1	12	14	10	37	147	225	93	23	97	1	5	5	4	36	190	247	82	24	99
2	9	18	12	32	134	212	98	21	122	2	5	6	4	36	180	242	73	28	117
3	8	16	15	35	137	212	92	19	123	3	4	7	7	37	183	232	78	24	115
4	11	19	18	35	128	202	97	21	126	4	5	7	7	44	180	231	79	26	110
5	17	20	21	42	133	192	87	19	126	5	4	7	9	46	189	232	74	29	99
6	16	27	25	40	132	183	91	16	127	6	6	8	13	46	191	231	76	26	92
7	13	27	32	50	144	198	95	24	74	7	5	12	16	58	203	231	76	24	64
8	14	34	41	53	140	217	102	20	35	8	4	11	20	64	221	231	87	23	28
9	18	38	45	53	143	205	111	28	16	9	5	11	22	77	235	230	80	25	5
10	18	33	48	62	136	198	120	32	6	10	5	12	20	76	251	226	79	20	...
11	20	29	44	73	156	191	107	38	7	11	5	7	24	79	262	220	76	21	2
Noon	17	25	41	92	177	184	91	37	2	Noon	8	5	22	85	260	226	74	18	1
13	12	23	37	116	191	170	77	30	2	13	5	7	15	90	267	220	75	17	1
14	8	20	38	110	210	172	82	25	2	14	6	5	14	75	275	223	80	15	2
15	7	16	23	105	238	172	73	27	4	15	2	6	11	64	271	245	78	14	4
16	7	10	25	97	259	171	67	22	6	16	7	2	5	58	256	254	91	15	5
17	7	9	15	79	275	185	71	20	4	17	9	2	4	50	247	257	97	19	11
18	10	12	7	66	272	198	71	24	7	18	6	6	2	43	234	274	93	26	13
19	10	7	7	51	262	207	82	26	15	19	7	4	6	38	221	277	99	26	18
20	12	10	8	45	240	213	85	28	27	20	7	4	3	38	206	273	100	25	39
21	9	10	6	40	221	219	88	30	43	21	7	4	3	38	200	261	96	26	57
22	12	12	6	40	198	223	89	27	57	22	7	3	2	37	196	253	96	25	74
23	12	11	7	38	191	227	91	28	59	23	8	5	3	36	190	251	85	22	91
Total	293	455	537	1427	4436	4805	2152	605	1176	Total	139	152	240	1288	5205	5816	2007	542	1142
Per-cent.	1'8	2'9	3'4	9'0	28'1	30'2	13'5	3'7	7'4	Per cent.	0'8	0'9	1'5	7'7	31'9	35'0	12'1	3'3	6'9

TABLE 2.—*Number of winds recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years.*—contd.

July.										August.									
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
0	2	5	3	17	167	308	103	21	86	0	20	4	2	22	116	282	116	28	104
1	3	6	3	19	170	303	99	27	82	1	19	4	3	21	112	283	113	27	112
2	3	6	3	19	159	303	109	25	86	2	17	6	3	17	111	279	111	26	122
3	6	6	3	21	167	288	105	24	90	3	17	8	5	19	109	271	111	24	127
4	4	8	4	23	159	284	101	26	100	4	19	9	6	17	102	263	113	24	135
5	6	9	5	21	153	286	100	26	102	5	17	9	7	20	103	256	111	21	141
6	5	9	8	23	150	266	93	30	104	6	17	7	7	21	109	258	108	23	132
7	6	8	8	29	168	289	99	32	69	7	18	7	8	21	121	261	115	27	105
8	7	4	12	32	193	289	98	32	40	8	19	8	11	29	137	263	127	25	65
9	8	7	11	36	207	302	96	28	14	9	21	7	13	31	152	270	121	29	45
10	10	5	12	41	226	290	92	25	8	10	18	8	13	35	163	281	118	25	27
11	4	4	12	46	241	285	100	21	6	11	19	5	14	39	184	291	116	26	20
Noon	2	4	12	49	248	281	104	17	4	Noon	20	7	12	41	186	265	128	27	19
13	4	3	9	46	250	284	99	20	1	13	17	7	8	46	193	270	126	28	11
14	6	3	9	50	238	273	117	18	2	14	18	7	9	41	193	265	134	27	13
15	4	2	5	43	226	294	120	18	4	15	20	5	8	45	182	276	132	24	12
16	4	2	5	32	208	318	123	20	4	16	22	3	5	43	21	297	120	26	10
17	5	2	2	24	208	318	122	24	11	17	19	5	4	31	167	296	131	31	18
18	4	2	2	22	187	334	118	29	18	18	20	6	2	31	148	300	131	27	36
19	6	1	2	17	190	320	124	28	27	19	18	6	3	26	137	300	136	24	49
20	4	...	3	15	187	318	121	25	42	20	18	6	3	21	122	302	133	25	69
21	4	3	1	18	178	309	113	28	61	21	17	7	3	23	120	291	133	29	76
22	5	3	2	18	171	295	111	29	77	22	19	5	3	23	113	280	127	28	96
23	2	6	2	19	167	291	111	26	88	23	19	5	2	22	116	276	115	27	113
Total	114	108	138	680	4618	7145	2578	599	1126	Total	448	151	154	685	3377	6666	2924	626	1657
Per cent.	0·7	0·6	0·8	4·0	27·0	41·8	15·1	3·5	6·6	Per cent.	2·7	0·9	0·9	4·1	20·2	39·9	17·5	3·8	9·9

TABLE 2.—*Number of winds recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years*—contd.

September										October.									
Hour	N	NE.	E.	SE	S.	SW	W.	NW	Calm	Hour	N	NE	E.	SE.	S	SW	W	NW	Calm.
0	14	21	13	41	147	193	94	21	146	0	30	45	53	68	142	97	53	28	199
1	10	18	11	38	136	185	98	23	180	1	32	47	61	70	137	98	53	26	190
2	12	23	16	38	131	191	90	25	164	2	31	62	59	63	117	93	52	27	207
3	15	22	17	40	122	181	96	20	183	3	31	70	66	73	119	83	46	30	194
4	13	23	25	42	125	167	89	20	193	4	33	75	75	75	118	73	49	24	191
5	15	28	28	46	118	164	90	22	184	5	35	96	75	81	111	69	37	26	183
6	16	27	33	50	114	165	92	22	176	6	36	108	78	85	106	61	44	27	167
7	19	36	41	55	121	181	95	18	179	7	37	120	93	81	112	70	47	28	124
8	18	42	48	66	128	194	101	26	71	8	43	144	113	86	109	74	50	32	60
9	22	46	60	71	140	172	106	21	50	9	47	154	132	91	100	76	47	36	27
10	16	47	62	85	138	185	101	24	33	10	49	163	140	84	105	82	45	24	17
11	16	53	61	91	165	170	94	22	28	11	40	155	153	93	107	82	46	32	8
Noon	17	46	55	89	179	192	83	25	16	Noon	37	144	159	98	117	80	42	35	7
13	14	46	63	89	189	179	81	23	18	13	36	122	148	126	128	84	40	34	1
14	19	36	48	91	205	185	80	24	14	14	35	101	133	130	158	83	38	35	6
15	14	31	40	84	218	200	81	21	13	15	33	84	99	135	191	90	36	37	5
16	12	28	31	73	224	207	90	17	18	16	29	64	89	129	215	104	43	35	11
17	16	21	25	66	218	221	93	19	20	17	26	50	81	115	217	118	48	32	32
18	15	17	21	58	220	221	92	16	41	18	22	40	60	105	199	110	49	27	103
19	13	12	15	50	211	218	95	21	64	19	19	27	35	86	180	107	51	27	184
20	10	11	13	42	196	227	87	21	89	20	23	28	38	71	166	110	50	29	201
21	11	16	13	38	191	217	90	19	103	21	23	36	41	70	149	97	54	27	217
22	13	16	10	43	171	209	98	20	117	22	22	40	47	70	137	94	52	29	225
23	12	21	13	46	161	201	94	23	135	23	31	44	51	63	138	97	46	24	227
Total	351	687	762	1434	3963	4630	2219	513	2183	Total	780	2019	2079	2149	3378	2136	1115	711	2786
Per cent	2·1	4·1	4·6	8·6	23·7	27·6	13·2	3·1	13·1	Per cent	4·6	11·8	12·1	12·5	19·7	12·5	6·5	4·2	16·2

TABLE 2.—*Number of winds recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years*—concld.

NOVEMBER.										DECEMBER.									
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Hour.	N	N E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
0	62	147	115	73	44	28	17	11	155	0	144	170	59	30	31	18	17	24	138
1	64	161	114	78	44	31	18	14	128	1	151	174	69	47	35	20	15	20	116
2	62	169	120	70	45	31	16	16	123	2	161	184	66	51	28	20	19	21	97
3	66	189	118	67	33	34	16	16	112	3	167	198	68	47	29	19	18	24	77
4	72	199	114	67	37	30	16	15	100	4	165	212	67	49	28	14	17	24	71
5	78	205	117	66	38	32	12	13	88	5	161	218	66	40	25	15	14	24	80
6	81	219	113	62	36	30	14	13	79	6	161	236	74	28	20	11	13	25	75
7	85	232	130	66	28	26	11	13	57	7	169	250	77	32	14	8	10	25	56
8	82	272	132	64	29	21	9	15	23	8	173	288	83	26	8	10	10	21	22
9	71	299	134	63	31	15	8	14	9	9	166	322	101	15	6	5	8	10	6
10	73	296	156	56	30	14	5	9	4	10	142	347	107	17	3	2	5	10	3
11	62	293	184	57	30	10	7	5	9	11	147	330	130	30	3	2	3	12	2
Noon	53	267	203	72	28	12	10	9	6	Noon	141	303	140	39	9	6	6	13	2
13	49	256	201	80	40	15	8	9	2	13	133	275	137	52	21	8	12	20	1
14	45	248	195	91	42	21	8	11	...	14	132	258	121	58	34	12	15	27	4
15	47	217	186	102	48	25	13	13	6	15	134	253	113	59	39	14	15	28	5
16	49	203	174	107	61	20	14	15	14	16	143	229	114	66	41	14	19	28	5
17	45	169	174	112	63	25	13	15	40	17	152	207	98	82	46	11	18	28	17
18	42	128	116	106	61	23	13	14	151	18	146	174	85	89	58	12	17	24	51
19	41	119	85	88	56	15	10	12	228	19	150	162	69	87	54	11	15	24	83
20	40	125	86	80	46	17	10	14	228	20	146	156	63	73	46	10	11	23	127
21	49	118	82	73	48	20	10	15	239	21	131	151	58	57	38	10	11	27	171
22	59	120	87	66	48	24	12	13	224	22	135	150	57	50	29	9	9	23	191
23	57	138	98	70	45	28	14	10	192	23	133	160	58	56	31	12	11	24	168
Total	1443	4789	3236	1836	1111	547	284	304	2217	Total	3583	5407	2080	1200	676	273	308	529	1563
Per cent.	9·2	30·4	20·5	11·6	7·1	3·5	1·8	1·9	14·1	Per cent.	22·9	34·6	13·3	7·7	4·3	1·7	2·0	3·4	10·0

TABLE 3.—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years.*

JANUARY.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
0	509	425	89	68	102	191	197	124
1	511	499	94	86	75	170	198	110
2	507	546	102	76	61	147	219	127
3	543	560	104	65	65	113	205	134
4	577	577	97	67	61	80	160	151
5	579	601	111	79	56	77	151	135
6	602	742	142	86	55	81	131	123
7	802	1028	200	115	51	90	156	170
8	1107	1687	304	108	60	136	189	181
9	1219	2128	385	119	56	80	111	176
10	1304	2087	396	148	66	53	114	136
11	1198	1734	465	149	68	94	188	184
Noon	956	1223	411	231	129	123	200	214
13	858	898	407	261	145	184	234	339
14	796	739	254	276	194	219	278	346
15	797	667	227	279	174	206	319	323
16	750	608	198	326	213	205	304	257
17	634	433	160	307	309	123	246	177
18	576	395	79	244	270	125	148	137
19	474	348	58	164	239	101	134	129
20	400	284	51	105	169	97	157	104
21	394	315	53	103	141	141	180	97
22	438	316	70	99	125	167	200	131
23	459	392	92	85	134	199	231	119
Total	16990	19232	4540	3646	3018	3200	4590	4114
Per cent.	28·6	32·4	7·7	6·1	5·1	5·4	7·7	6·9

FEBRUARY.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
0	44	41	21	114	299	771	759	125
1	53	33	28	86	270	704	739	149
2	47	42	27	79	186	630	692	141
3	36	44	31	55	151	506	598	162
4	50	46	41	39	116	419	515	116
5	46	68	31	52	101	310	399	114
6	68	106	62	60	96	268	369	116
7	166	199	119	74	124	281	403	163
8	341	466	170	184	161	317	417	254
9	460	643	300	314	154	258	360	279
10	611	748	301	285	223	242	291	284
11	588	637	315	341	272	268	316	275
Noon	508	452	236	396	323	338	381	353
13	419	311	242	452	452	490	416	361
14	406	240	171	579	451	492	326	328
15	422	210	157	735	602	540	497	261
16	258	160	170	880	825	521	451	202
17	163	107	96	791	1193	414	354	136
18	101	58	48	495	1250	402	248	135
19	88	50	29	369	1099	445	269	96
20	66	43	20	241	835	476	296	93
21	69	50	15	164	673	636	407	99
22	74	49	24	141	477	806	549	110
23	64	43	20	133	422	860	639	120
Total	5148	4946	2674	6979	10755	11384	10891	4472
Per cent.	9·0	8·6	4·7	12·2	18·8	19·9	19·0	7·8

TABLE 3.—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years*—contd.

MARCH.									APRIL.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
0	4	3	1	47	527	1671	879	46	0	18	30	31	74	385	1569	668	148
1	2	3	3	32	400	1475	878	46	1	36	28	32	49	316	1545	869	133
2	2	6	6	32	334	1330	857	54	2	31	54	52	31	275	1417	795	127
3	12	9	2	30	271	1106	748	57	3	50	61	50	41	245	1231	721	119
4	23	6	3	21	203	908	592	46	4	62	78	32	52	245	1016	582	115
5	25	14	13	23	173	630	474	50	5	83	87	21	38	211	882	503	80
6	21	19	17	24	143	557	344	53	6	96	78	30	50	221	915	302	85
7	39	29	10	38	192	620	399	55	7	108	119	52	47	270	1187	669	100
8	83	55	38	67	277	726	478	119	8	134	167	87	67	271	1159	838	226
9	121	108	87	123	386	725	426	213	9	143	195	107	109	347	1058	749	312
10	130	168	115	333	526	702	385	193	10	140	156	113	212	484	1107	684	238
11	166	123	146	401	700	786	377	172	11	119	112	122	369	599	1151	576	242
Noon	145	92	172	507	730	850	415	168	Noon	59	55	188	352	680	1077	590	238
13	128	65	167	822	840	904	439	144	13	94	61	168	835	944	1014	572	153
14	138	59	186	1217	971	700	389	144	14	78	39	163	1431	1261	812	453	135
15	98	66	121	1694	1405	560	333	107	15	25	41	103	1617	2121	800	360	88
16	30	37	88	1540	2496	497	194	71	16	41	23	87	1209	3306	924	371	51
17	13	19	20	1059	3619	633	156	48	17	8	18	29	815	4087	1187	405	61
18	2	10	14	535	3558	727	143	38	18	30	8	25	584	3617	1283	358	37
19	6	6	9	252	2907	876	142	27	19	24	33	25	212	2812	1500	462	39
20	3	6	15	161	1895	1157	206	29	20	34	27	30	91	1794	1731	538	80
21	7	2	7	104	1334	1422	370	28	21	52	33	25	74	1104	1693	732	96
22	9	2	2	76	917	1666	578	33	22	61	47	27	40	767	1685	783	112
23	6	1	1	59	654	1775	814	37	23	24	42	35	45	533	1664	861	141
Total	1213	908	1213	9197	25448	23001	10986	2008	Total	1550	1591	1643	8645	26895	29617	14851	3157
Per cent.	1·6	1·1	1·6	12·4	34·4	31·1	14·9	2·7	Per cent.	1·8	1·8	1·9	9·8	30·6	33·6	16·9	3·6

TABLE 3.—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years.*—contd.

MAY.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
0	35	46	55	143	463	760	347	64
1	38	59	56	13	403	712	346	36
2	39	62	80	139	393	684	352	38
3	41	70	89	143	371	616	363	60
4	80	61	91	161	394	557	319	69
5	61	114	117	149	395	524	281	62
6	60	114	129	209	435	591	314	80
7	77	167	179	252	546	788	406	79
8	70	184	203	263	621	895	502	124
9	80	156	239	332	630	923	588	148
10	76	153	216	442	760	1025	529	169
11	71	144	233	565	1087	986	491	179
Noon	65	129	195	694	1266	1048	448	146
13	55	105	200	726	1499	1078	466	134
14	37	77	120	701	1857	1138	453	113
15	59	66	118	703	2095	1282	404	102
16	31	47	75	357	2340	1305	454	72
17	53	72	36	438	2213	1396	394	88
18	38	40	38	287	1862	1272	370	90
19	59	52	35	220	1391	1127	347	97
20	37	39	19	167	1076	1004	332	112
21	37	47	27	146	786	907	326	76
22	30	43	32	142	684	852	340	82
23	39	56	28	126	575	820	362	55
Total	1268	2103	2610	7839	24132	22290	9534	2315
Per cent.	1·8	2·9	3·6	10·9	33·5	30·9	13·2	3·3

JUNE.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
0	8	16	10	140	744	916	235	45
1	7	14	12	136	678	879	203	52
2	7	18	19	111	633	802	224	34
3	7	25	13	141	629	815	216	46
4	4	22	34	149	660	729	188	48
5	10	25	42	160	693	716	207	35
6	17	35	65	199	742	770	234	49
7	13	43	93	208	970	905	317	51
8	9	46	100	360	1258	1155	334	61
9	13	50	91	463	1565	1311	343	46
10	16	31	110	476	1921	1415	366	65
11	24	23	124	560	2083	1641	424	59
Noon	22	36	78	620	2328	1750	434	57
13	18	28	71	559	2537	1876	534	65
14	8	18	47	477	2421	2221	514	58
15	20	10	26	416	2353	2193	586	64
16	55	13	20	392	2121	1987	608	45
17	31	27	9	288	1855	1902	486	60
18	33	17	22	214	1559	1662	449	63
19	31	13	9	203	1249	1492	405	51
20	25	6	17	172	1046	1218	317	44
21	14	4	6	144	920	1074	289	46
22	18	10	10	143	761	994	239	32
23	12	17	17	140	777	965	241	26
Total.	422	547	1045	6931	32503	31388	8393	1202
Per cent.	0·5	0·7	1·3	8·4	39·4	38·1	10·1	1·5

TABLE 3.—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years.*—contd.

JULY.									AUGUST.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
0	4	14	11	73	646	1129	349	55	0	64	14	10	52	380	949	354	59
1	9	19	12	80	590	1152	411	63	1	55	20	7	55	384	962	356	56
2	16	20	12	93	565	1073	374	64	2	53	29	13	47	399	913	370	51
3	8	27	13	89	564	1053	355	65	3	61	23	15	55	317	832	322	60
4	17	28	17	84	544	1034	311	56	4	58	23	24	40	309	805	329	56
5	8	24	30	85	560	1026	277	69	5	61	17	20	53	298	828	309	56
6	17	19	29	134	629	1062	333	89	6	68	17	21	65	374	866	316	64
7	27	21	53	139	812	1219	358	101	7	70	28	33	88	565	985	436	81
8	33	39	61	192	1109	1504	307	93	8	111	28	53	124	751	1295	508	94
9	35	31	58	231	1393	1681	448	64	9	110	36	51	159	939	1514	546	84
10	9	24	65	300	1701	1812	596	57	10	111	22	68	176	1182	1677	585	95
11	8	20	65	323	1917	2004	709	67	11	116	34	52	223	1317	1792	776	128
Noon	11	11	44	323	2021	2259	657	97	Noon	140	29	35	266	1403	1969	751	128
13	30	12	45	356	2116	2321	821	81	13	136	33	42	259	1506	1992	884	141
14	15	4	23	322	2061	2605	833	82	14	146	19	21	261	1449	2111	882	150
15	23	7	27	232	1888	2686	874	76	15	144	13	16	245	1381	2173	781	150
16	25	9	8	153	1620	2412	760	86	16	134	16	8	175	1154	1889	746	170
17	14	6	6	120	1435	2409	618	106	17	122	26	4	179	964	1827	740	137
18	13	2	4	94	1285	1989	631	99	18	89	14	6	114	774	1513	622	91
19	15	1	6	88	1168	1768	512	83	19	75	22	11	87	609	1368	518	83
20	13	13	2	87	931	1482	504	91	20	71	15	3	79	486	1180	449	74
21	20	6	7	94	808	1283	418	86	21	68	15	6	69	432	1035	410	74
22	4	11	4	73	727	1162	383	67	22	64	13	7	59	369	926	361	62
23	4	14	12	63	694	1220	373	56	23	69	7	3	67	396	914	337	55
Total	378	382	614	3828	27784	39435	12212	1853	Total.	2196	513	529	2977	18129	32315	12688	2200
Per cent.	0·4	0·4	0·7	4·4	32·1	45·6	14·1	2·1	Per cent.	3·1	0·7	0·7	4·2	25·3	45·2	17·7	3·1

TABLE 3.—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years*—contd.

September.									October.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Hour.	N.	N.E.	E.	S.E	S.	S.W.	W.	N.W.
0	38	63	31	109	339	562	283	60	0	113	168	182	172	279	226	122	87
1	35	79	60	119	328	542	271	68	1	103	207	200	164	230	151	122	56
2	51	70	62	135	296	457	249	57	2	117	289	224	177	248	156	106	64
3	33	68	78	122	318	426	244	53	3	134	335	297	224	259	146	98	50
4	37	94	91	139	308	370	228	60	4	144	426	375	232	229	119	66	59
5	45	96	107	142	276	393	207	55	5	150	472	267	242	256	112	72	64
6	62	129	149	193	331	453	219	48	6	165	541	376	267	277	138	80	74
7	61	164	164	230	398	535	282	76	7	229	745	491	335	303	176	121	86
8	106	216	272	273	541	662	347	66	8	258	876	682	406	347	225	133	112
9	79	218	286	389	648	789	422	101	9	283	988	794	398	422	290	144	87
10	94	273	291	468	821	863	453	89	10	211	854	874	499	470	309	152	109
11	88	232	288	464	1075	997	384	116	11	188	751	929	532	560	343	157	131
Noon	64	213	300	481	1247	1005	433	108	Noon	166	633	821	687	651	396	142	103
13	91	157	242	497	1344	1103	432	105	13	161	493	716	708	833	381	145	124
14	63	134	174	458	1453	1307	433	94	14	128	355	488	639	978	456	127	127
15	63	119	122	390	1553	1337	494	79	15	99	217	359	574	1037	455	142	121
16	79	83	82	311	1375	1288	486	83	16	67	125	253	445	913	491	159	75
17	69	67	53	221	1161	1099	402	63	17	33	80	123	325	667	393	120	45
18	57	50	43	175	943	939	370	69	18	57	64	65	229	538	330	124	56
19	38	45	48	132	813	906	294	73	19	56	69	78	170	432	322	130	61
20	47	58	29	102	634	773	294	53	20	75	100	98	138	359	244	147	57
21	35	30	27	128	530	686	293	50	21	73	101	110	168	324	214	119	54
22	35	57	47	128	450	622	271	60	22	105	119	121	139	309	232	125	55
23	38	51	46	125	350	582	287	51	23	92	142	136	171	307	226	133	67
Total	1408	2776	3092	5911	17402	18714	8078	1741	Total	3208	9121	8959	8041	11228	6561	2695	1894
Per cent	2·4	4·7	5·2	10·0	29·5	31·6	13·6	2·9	Per cent.	6·2	17·5	17·2	15·5	21·6	12·6	5·8	3·6

TABLE 3.—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Rangoon during 23-24 years.*—concld.

NOVEMBER.									DECEMBER.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
0	346	724	352	195	91	57	56	36	0	844	906	237	99	64	38	34	87
1	332	824	450	152	86	73	24	40	1	891	962	256	124	58	35	37	89
2	391	955	472	150	72	61	30	39	2	948	1083	284	134	65	29	28	82
3	404	1044	443	164	98	59	29	25	3	991	1232	293	124	52	28	30	79
4	431	1087	405	208	96	67	22	19	4	884	1273	289	113	42	25	28	92
5	413	1201	529	216	87	43	25	24	5	879	1368	335	80	36	18	19	84
6	457	1348	595	219	88	48	20	35	6	944	1541	369	98	33	18	16	74
7	543	1784	719	281	97	43	25	45	7	1156	2023	442	90	20	23	18	90
8	550	2239	869	339	114	51	20	46	8	1427	2617	723	67	10	14	24	47
9	591	2233	1137	317	98	41	14	38	9	1329	2922	794	99	5	5	15	75
10	450	2124	1319	312	92	29	17	18	10	1272	2554	924	161	7	7	11	61
11	364	1810	1409	430	116	33	22	26	11	1085	2184	1000	203	34	17	23	80
Noon	306	1548	1278	439	170	56	27	33	Noon	873	1785	851	270	83	31	47	118
13	258	1377	1126	440	177	81	27	37	13	765	1473	716	300	141	42	76	161
14	230	1103	1004	473	210	106	37	49	14	706	1352	534	277	150	49	64	169
15	220	908	838	470	251	66	46	49	15	794	1176	569	276	155	53	84	137
16	173	560	585	387	214	67	30	47	16	782	838	381	329	175	34	64	121
17	120	285	260	267	176	40	22	28	17	700	645	235	285	186	32	38	82
18	138	336	176	177	130	24	14	24	18	763	650	173	191	135	24	33	81
19	204	392	179	151	111	28	8	27	19	712	624	149	124	89	23	21	89
20	223	385	202	145	101	37	13	48	20	688	620	153	95	62	17	17	102
21	313	428	243	158	95	50	29	34	21	748	638	167	93	50	29	19	108
22	317	549	288	154	89	57	24	29	22	758	755	190	86	48	24	27	106
23	340	661	342	191	97	56	38	19	23	777	813	199	95	50	36	37	107
Total	8114	25905	15310	6435	2955	1273	599	815	Total	21810	32034	10270	3814	1750	651	810	2305
Per cent.	13·2	42·2	24·9	10·5	4·8	2·1	1·0	1·3	Per cent.	29·7	43·6	14·0	5·2	2·4	0·9	1·1	3·1

TABLE 4.—*Number of miles recorded under each octant of the compass in each month of the year at Rangoon during 23-24 years.*

Month	N.	N E.	E.	S.E.	S	S.W	W	N W	Total
January .	16990	19232	4540	3646	3018	3200	4590	4114	59330
February .	5148	4946	2674	6979	10755	11384	10891	4472	57249
March . .	1213	928	1213	9197	25448	23001	10986	2008	73974
April .	1550	1591	1643	8645	26895	29617	14851	3157	87949
May . .	1268	2103	2610	7839	24132	22290	9534	2315	72091
June . .	422	547	1045	6931	32503	31388	8393	1202	82431
July . .	378	382	614	3828	27784	39435	12212	1853	86486
August .	2196	513	529	2997	18129	32315	12688	2200	71567
September .	1408	2776	3092	5911	17492	18714	8078	1741	59212
October .	3208	9121	8959	8041	11228	6561	2995	1894	52007
November	8114	25905	15310	6435	2956	1273	599	815	61407
December .	21810	32034	10270	3814	1750	651	810	2306	73445
Sum .	63705	100058	52499	74263	202090	219829	96627	28077	837148
Percentage	7 6	12 0	6 3	8 9	24 1	26 3	11'5	3'4	100 1

TABLE 5.—*Mean co-ordinates of the wind movement in each hour of each month at Rangoon as registered by a Beckley's anemograph from June 1878 to October 1901.*

	January.		February		March.		April.		May.		June		July		August		September		October		November		December	
	N.	E.	N	E.	N	E	N	E.	N.	E	N	E	N	E	N	E.	N	E	N.	E	N.	E	N	E
Midnight to 1 .	+0·05	+0·03	−1·22	−2·02	−2·60	−3·14	−2·17	−3·06	−1·50	−1·13	−2·05	−1·15	−2·03	−1·56	−1·40	−1·36	−0·88	−0·82	−0·11	+0·15	+0·91	+1·33	+2·15	+1·28
1 to 2 .	+1·07	+0·17	−1·01	−1·97	−2·18	−2·91	−2·00	−3·05	−1·34	−1·06	−1·94	−1·08	−1·06	−1·67	−1·44	−1·47	−0·91	−0·72	−0·27	+0·23	+1·07	+1·59	+2·20	+1·39
2 to 3	+1·19	+0·20	−0·82	−1·81	−1·92	−2·76	−1·76	−2·75	−1·30	−0·89	−1·70	−1·02	−1·85	−1·53	−1·39	−1·42	−0·81	−0·60	−0·16	+0·11	+1·31	+1·77	+2·36	+1·61
3 to 4 .	+1·31	+0·26	−0·59	−1·50	−1·55	−2·36	−1·50	−2·40	−1·18	−0·02	−1·81	−1·01	−1·83	−1·48	−1·20	−1·28	−0·62	−0·53	−0·16	+0·04	+1·39	+1·86	+2·72	+1·77
4 to 5 .	+1·45	+0·36	−0·47	−1·25	−1·22	−1·90	−1·24	−1·95	−1·11	−0·78	−1·78	−0·85	−1·78	−1·39	−1·16	−1·27	−0·73	−0·40	+0·01	+0·77	+1·42	+2·05	+2·66	+1·80
5 to 6 .	+1·46	+0·46	−0·29	−0·91	−0·66	−1·34	−1·02	−1·66	−1·04	−0·60	−1·83	−0·82	−1·80	−1·33	−1·19	−1·27	−0·72	−0·38	+0·03	+0·81	+1·56	+2·25	+2·80	+1·97
6 to 7 .	+1·53	+0·71	−0·17	−0·71	−0·71	−1·13	−1·07	−1·69	−1·21	−0·66	−1·66	−0·85	−1·95	−1·42	−1·33	−1·31	−0·72	−0·28	+0·05	+1·01	+1·79	+2·51	+3·07	+2·26
7 to 8 .	+2·28	+1·05	+0·03	−0·06	−0·30	−1·21	−1·36	−2·18	−1·57	−0·83	−2·49	−0·99	−2·35	−1·59	−1·72	−1·57	−1·01	−0·31	+0·21	+1·31	+2·31	+3·23	+3·68	+2·88
8 to 9 .	+3·12	+1·81	+0·51	−0·21	−0·97	−1·36	−1·13	−2·43	−1·75	−1·07	−3·25	−1·17	−3·08	−1·71	−2·26	−1·93	−1·29	−0·35	+0·23	+1·71	+2·76	+4·01	+5·08	+3·69
9 to 10 .	+4·15	+2·53	+1·12	+0·38	−0·98	−1·29	−1·01	−2·16	−1·87	−1·17	−3·07	−1·23	−3·73	−2·03	−2·79	−2·15	−1·70	−0·49	+0·16	+1·80	+2·87	+4·36	+5·20	+4·49
10 to 11 .	+4·13	+2·68	+1·20	+0·59	−1·32	−0·33	−1·51	−1·85	−2·25	−1·11	−4·56	−1·36	−4·35	−2·26	−3·28	−2·31	−2·01	−0·44	−0·20	+1·03	+2·13	+4·55	+4·55	+4·23
11 to noon	+3·55	+2·26	+0·85	+0·49	−1·77	−0·82	−2·02	−1·70	−2·83	−0·87	−5·09	−1·56	−4·93	−2·68	−3·56	−2·70	−2·53	−0·56	−0·51	+1·87	+1·81	+4·13	+3·79	+3·91
Noon to 13 .	+2·41	+1·53	+0·33	−0·05	−2·05	−0·87	−2·13	−1·40	−3·36	−0·77	−5·62	−1·08	−5·25	−2·85	−3·87	−2·82	−2·26	−0·61	−1·02	+1·75	+1·37	+3·62	+2·92	+3·27
13 to 14 .	+1·05	+0·05	−0·38	−0·38	−2·71	−0·58	−3·11	−0·90	−3·83	−0·80	−6·01	−2·04	−5·47	−3·03	−4·02	−3·03	−3·13	−0·83	−1·40	+1·48	+1·03	+2·13	+2·33	+2·65
14 to 15 .	+1·50	+0·45	−0·61	−0·57	−3·11	+0·16	−4·09	+0·12	−4·49	−1·01	−6·14	−2·49	−5·66	−3·36	−4·06	−3·21	−3·53	−1·20	−1·78	+0·90	+0·65	+3·01	+2·25	+2·23
15 to 16 .	+1·51	+0·31	−1·20	−0·38	−4·23	+0·85	−5·71	+0·44	−5·01	−1·09	−5·95	−2·68	−5·10	−3·67	−4·03	−3·08	−3·67	−1·45	−1·93	+0·51	+0·10	+2·56	+2·02	+2·02
16 to 17 .	+1·10	+0·35	−2·07	−0·08	−5·82	+0·02	−7·27	+0·16	−5·33	−1·39	−5·33	−2·50	−4·67	−3·36	−3·31	−2·03	−3·30	−1·57	−1·03	+0·13	+0·10	+1·71	+1·56	+1·57
17 to 18 .	+0·70	+0·35	−3·73	−0·02	−7·23	+0·22	−8·36	+1·01	−5·01	−1·57	−4·76	−2·36	−4·37	−3·22	−3·08	−2·82	−2·75	−1·38	−1·37	−0·14	−0·03	+0·69	+1·22	+1·18
18 to 19	+0·65	+0·29	−2·63	−0·30	−6·70	−0·43	−7·19	−1·32	−4·25	−1·59	−4·02	−2·13	−3·74	−2·85	−2·52	−2·37	−2·27	−1·20	−1·11	−0·17	+0·18	+0·75	+1·51	+1·01
19 to 20 .	+0·59	+0·19	−2·37	−0·52	−5·57	−0·91	−6·07	−2·08	−3·23	−1·48	−3·51	−1·92	−3·36	−2·15	−2·13	−2·09	−2·05	−1·17	−0·68	−0·21	+0·30	+0·79	+1·56	+0·93
20 to 21 .	+0·56	+0·01	−1·89	−0·76	−4·27	−1·90	−4·58	−2·32	−2·61	−1·44	−2·61	−1·51	−2·73	−2·16	−1·78	−1·81	−1·61	−1·06	−0·62	−0·13	+0·18	+0·77	+1·62	+0·85
21 to 22 .	+0·57	0	−1·69	−1·21	−3·63	−2·00	−3·14	−2·05	−2·12	−1·79	−2·50	−1·40	−2·39	−1·81	−1·58	−1·62	−1·43	−0·95	−0·53	−0·01	+0·61	+0·87	+1·78	+0·87
22 to 23 .	+0·67	−0·06	−1·53	−1·05	−3·23	−2·63	−2·82	−3·05	−1·91	−1·26	−2·20	−1·22	−2·17	−1·67	−1·36	−1·44	−1·21	−0·83	−0·47	−0·02	+0·75	+1·67	+1·70	+1·03
23 to Mid night	+0·75	−0·01	−1·51	−1·89	−2·93	−3·13	−2·47	−3·17	−1·69	−1·24	−2·19	−1·18	−2·17	−1·70	−1·40	−1·40	−1·06	−0·61	−0·19	+0·02	+0·81	+1·31	−1·93	+1·69
TOTAL .	+29·73	+16·98	−19·65	−17·01	−68·15	−32·16	−75·72	−41·69	−61·85	−26·12	−83·52	−36·23	−79·02	−52·78	−55·83	−48·75	−43·17	−16·63	−11·72	+17·07	+28·50	+45·28	+63·40	+50·32
Mean of day .	+1·66	+0·71	−0·70	−0·73	−2·65	−1·31	−3·16	−1·60	−2·58	−1·09	−3·48	−1·51	−3·29	−2·21	−2·33	−2·03	−1·80	−0·70	−0·61	+0·71	+1·19	+1·89	+2·61	+2·10

N and E. are treated as positive, S. and W as negative values

TABLE 6.—*Hourly co-ordinates of the mean diurnal variation of wind movement at Rangoon from the 23 24 years' registers of a Beckley's anemograph. East and North are designated by + South and West by — signs.*

Hour.	North and South components.		East and West components.	
	Observed	Computed.	Observed.	Computed.
Midnight to 1	+0'401	+0 327	—0'452	—0'518
1 to 2	+0'531	+0'504	—0 422	—0'445
2 to 3	+0'691	+0 726	—0'322	—0'286
3 to 4	+0'821	+0'890	—0'082	—0'087
4 to 5	+0'931	+0'947	+0'098	+0 089
5 to 6	+1'021	+0'952	+0'258	+0'218
6 to 7	+1'121	+1 001	+0'368	+0'341
7 to 8	+1'021	+1'119	+0'418	+0'456
8 to 9	+1 121	+1 213	+0 588	+0'609
9 to 10	+1'051	+1'141	+0 778	+0'736
10 to 11	+1'171	+0'823	+0'808	+0'765
11 to Noon	+0'161	+0 311	+0'678	+0'667
Noon to 13	—0'349	—0'264	+0'448	+0'472
13 to 14	—0'799	—0'788	+0'238	+0'252
14 to 15	—1 159	—1'220	+0'078	+0'063
15 to 16	—1 509	—1'557	+0'028	—0'084
16 to 17	—1'759	—1'765	—0'262	—0'206
17 to 18	—1'899	—1'763	—0'352	—0'316
18 to 19	—1'439	—1'492	—0'362	—0 387
19 to 20	—0 949	—1 001	—0'412	—0'443
20 to 21	—0'429	—0'458	—0'412	—0'447
21 to 22	—0'109	—0'046	—0'462	—0'445
22 to 23	+0'131	+0'161	—0'482	—0'469
23 to Midnight	+0'231	+0'238	—0'512	—0'509

WIND ROSES SHOWING THE PERCENTAGE NUMBER OF CALMS AND OF MILES OF WIND IN THE DIFFERENT DIRECTIONS DURING THE MONTHS JANUARY TO APRIL AT RANGOON.

Fig 1.

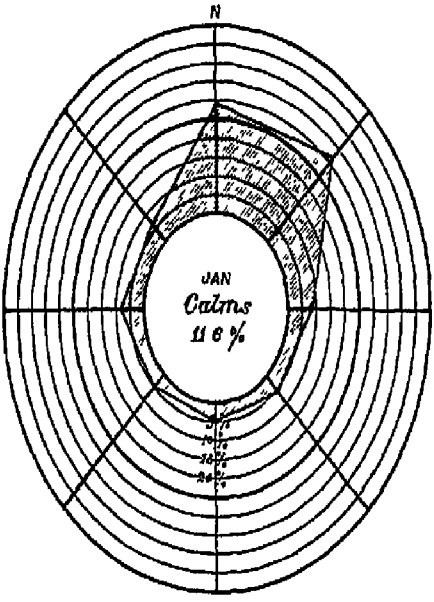


Fig 2.

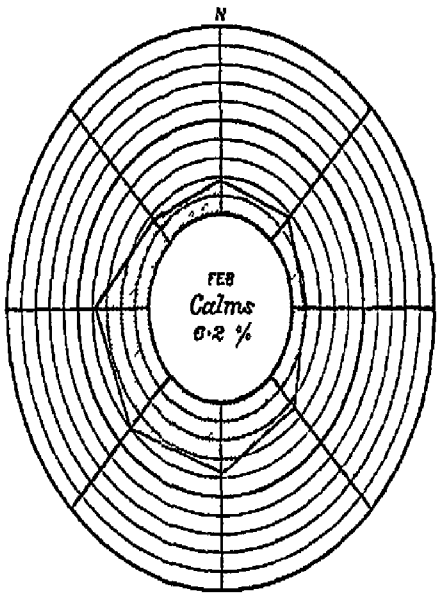


Fig 3.

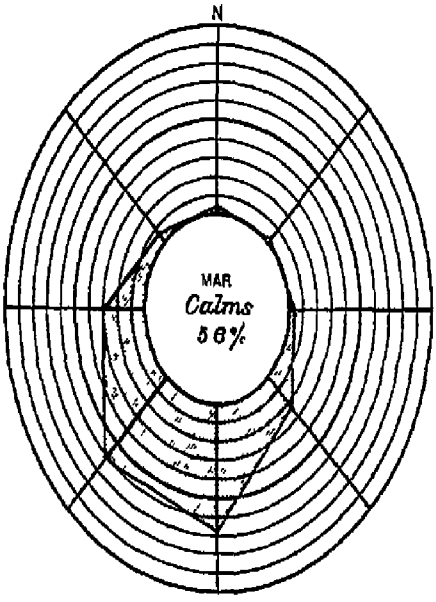
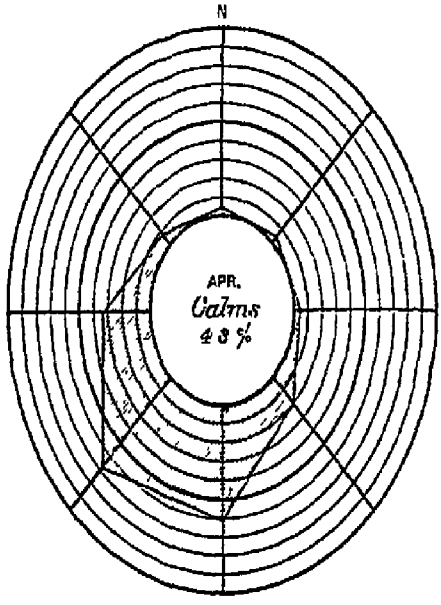


Fig 4



WIND ROSES SHOWING THE PERCENTAGE NUMBER OF CALMS AND OF MILES OF WIND IN THE DIFFERENT DIRECTIONS DURING THE MONTHS MAY TO AUGUST AT RANGOON.

Fig 1.

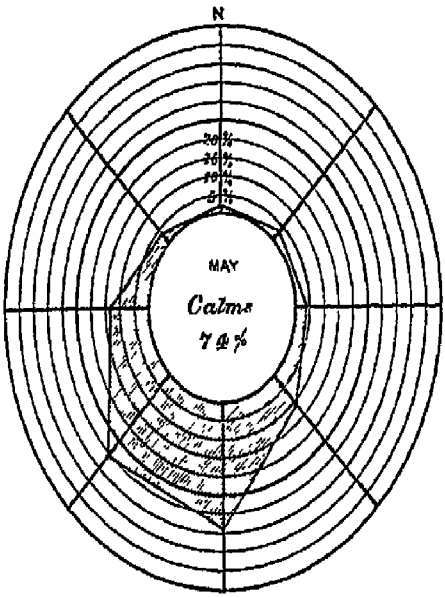


Fig. 2

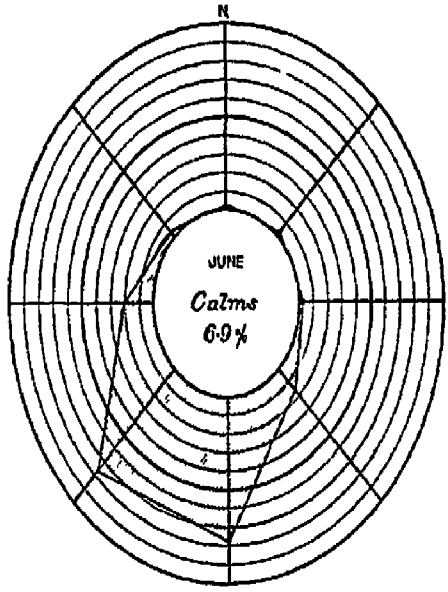


Fig 3

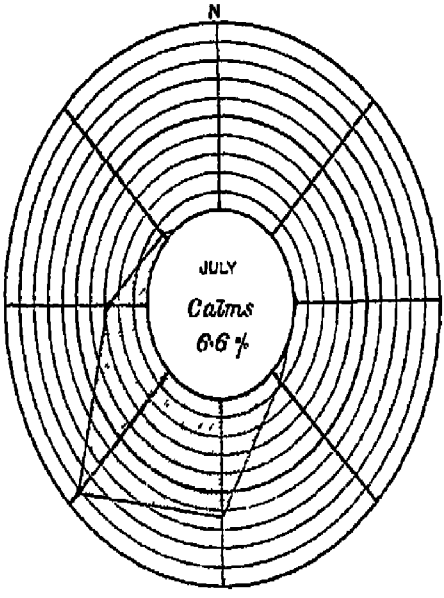
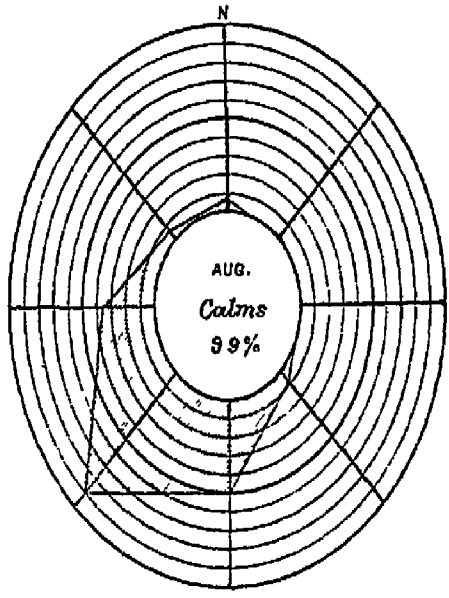


Fig. 4.



WIND ROSES SHOWING THE PERCENTAGE NUMBER OF CALMS AND OF MILES OF WIND IN THE DIFFERENT DIRECTIONS DURING THE MONTHS SEPTEMBER TO DECEMBER AND THE YEAR AT RANGOON.

Fig 1.

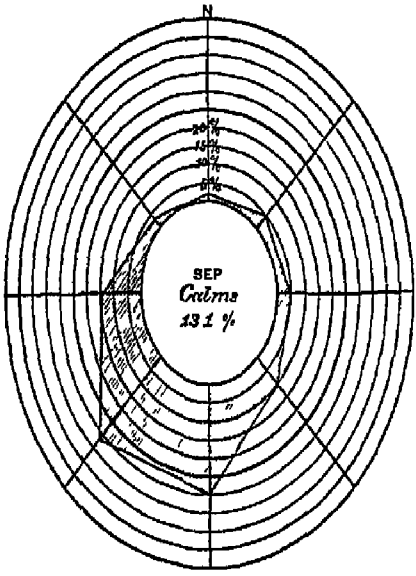


Fig 2.

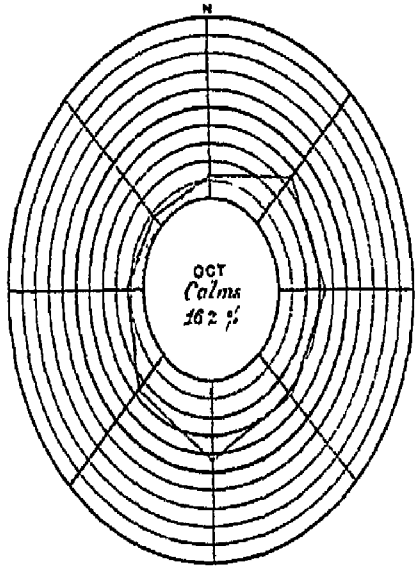


Fig 3

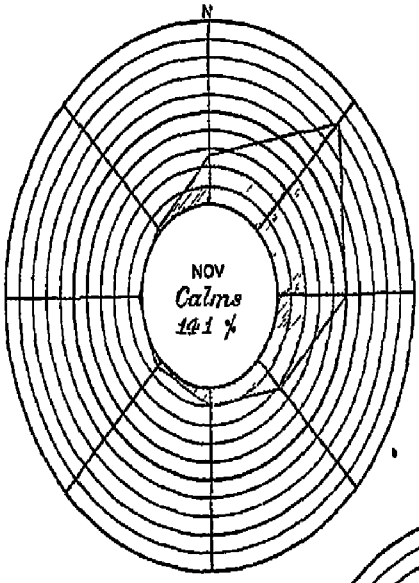


Fig 4

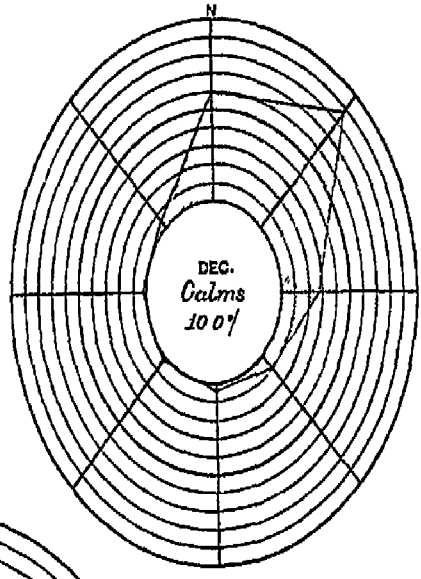
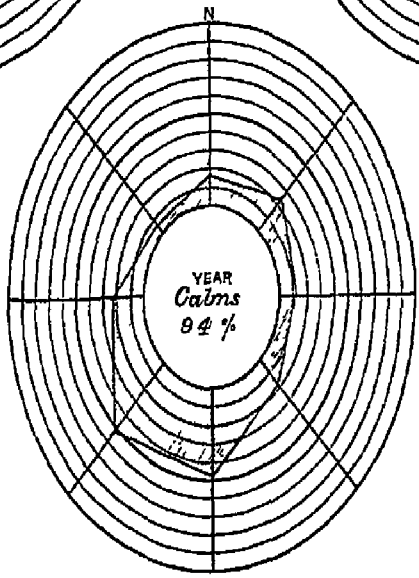
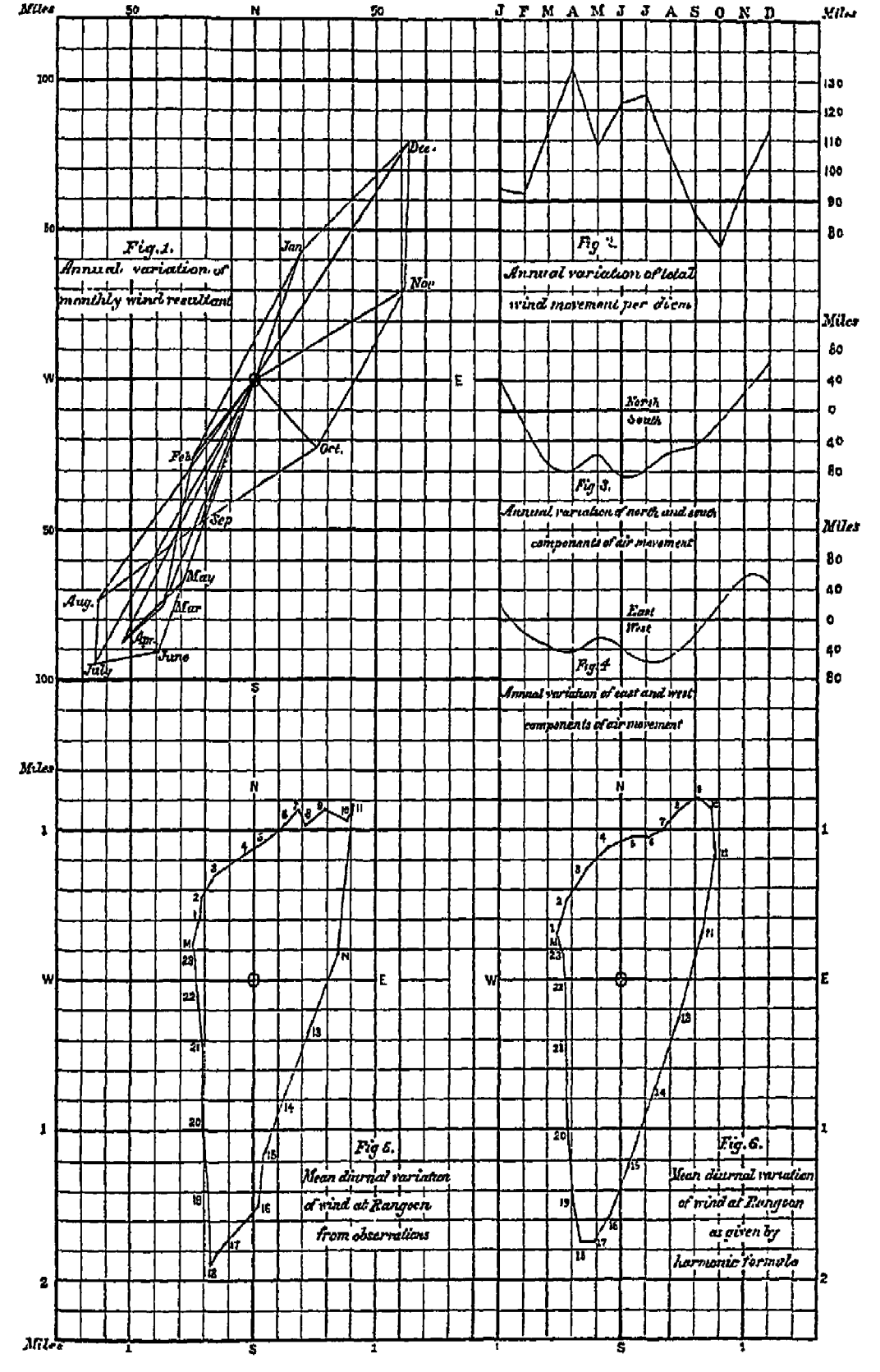


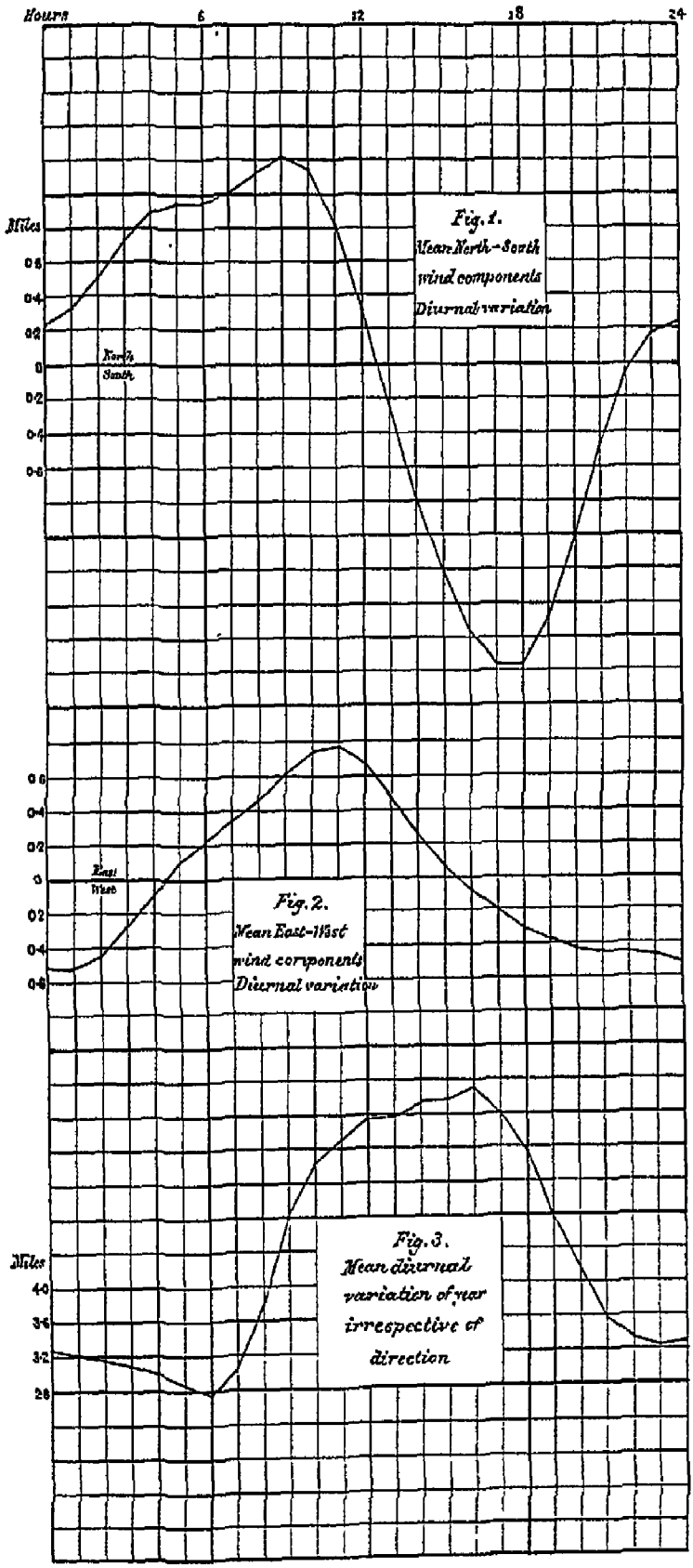
Fig 5.



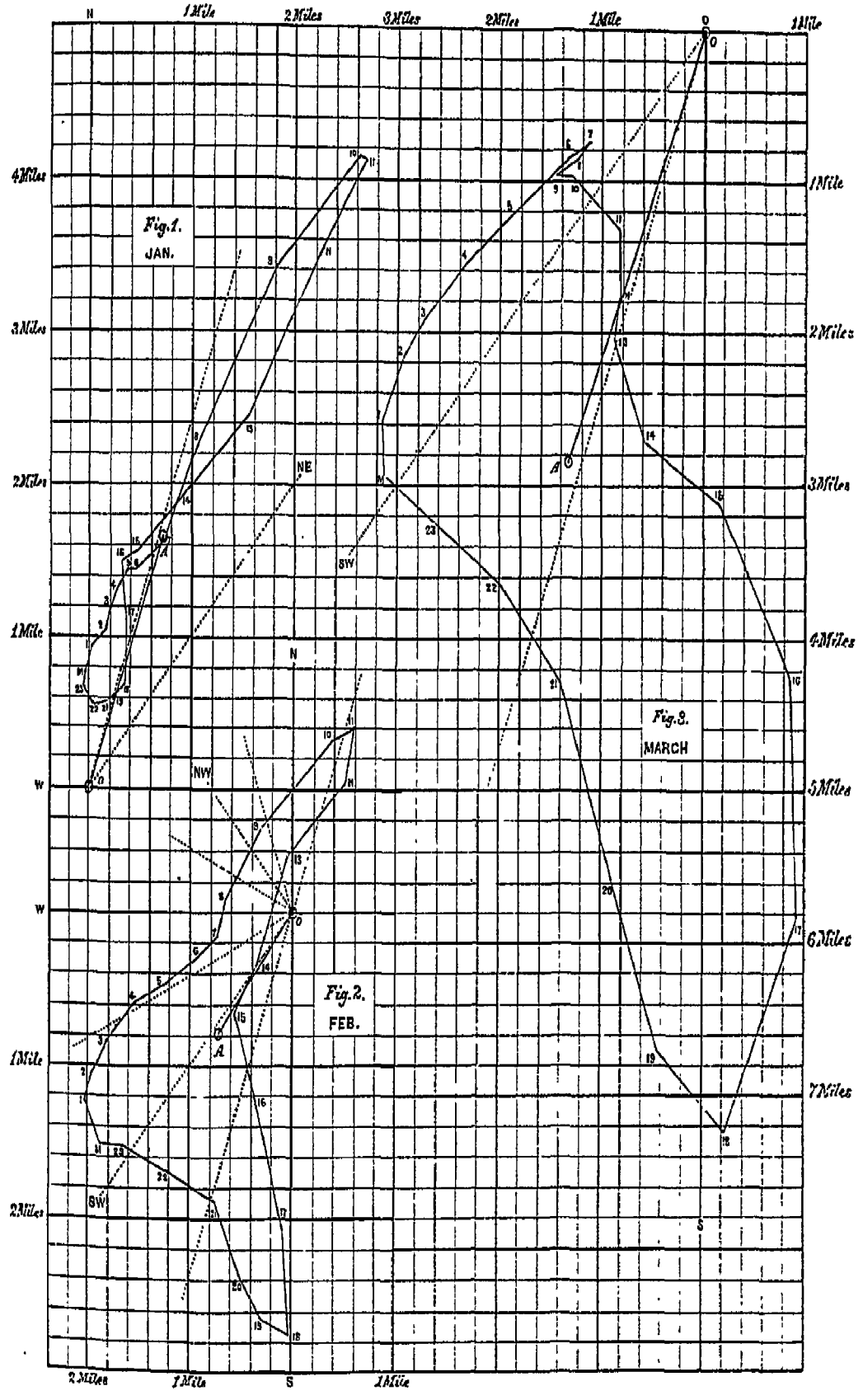
ANNUAL VARIATION, i.e. MEANS FOR THE DIFFERENT MONTHS OF THE YEAR, OF (1) THE DAILY RESULTANT AIR MOVEMENT, (2) THE TOTAL DAILY AIR MOVEMENT IRRESPECTIVE OF DIRECTION, (3) THE NORTH AND SOUTH COMPONENTS OF THE RESULTANT DAILY AIR MOVEMENT, AND (4) THE EAST AND WEST COMPONENTS OF THE SAME, ALSO (5) THE MEAN FOR THE YEAR OF THE DAILY VARIATION OF RESULTANT AIR MOVEMENTS DURING SUCCESSIVE HOURS, AND (6) THE SAME AS SMOOTHED BY THE HARMONIC FORMULA



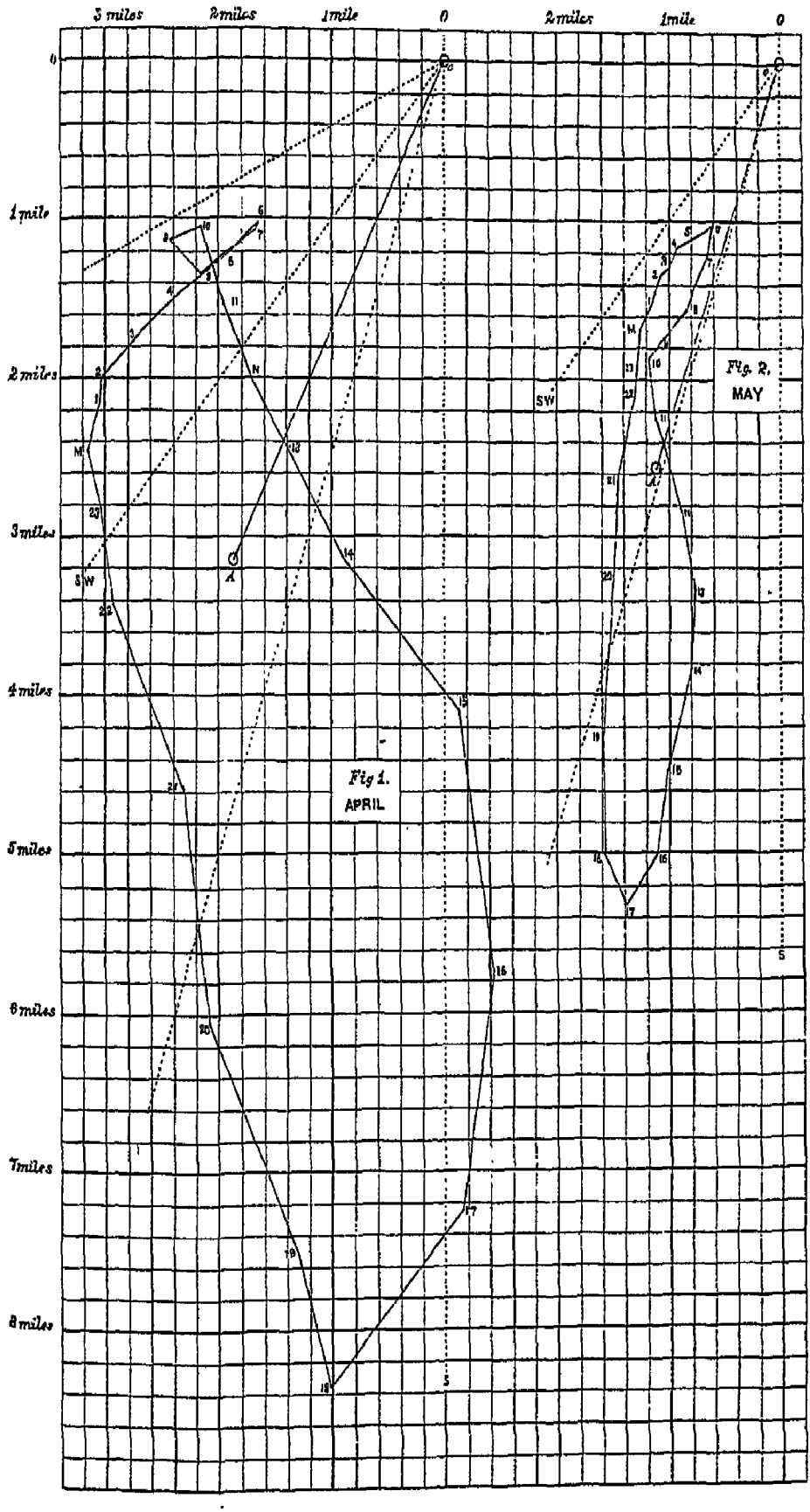
AVERAGES DURING THE YEAR OF (1) THE NORTH-SOUTH COMPONENTS AND (2) THE EAST-WEST COMPONENTS OF THE RESULTANT WIND MOVEMENTS DURING SUCCESSIVE HOURS OF THE DAY: ALSO (3) OF THE WIND MOVEMENT IRRESPECTIVE OF DIRECTION DURING SUCCESSIVE HOURS OF THE DAY.



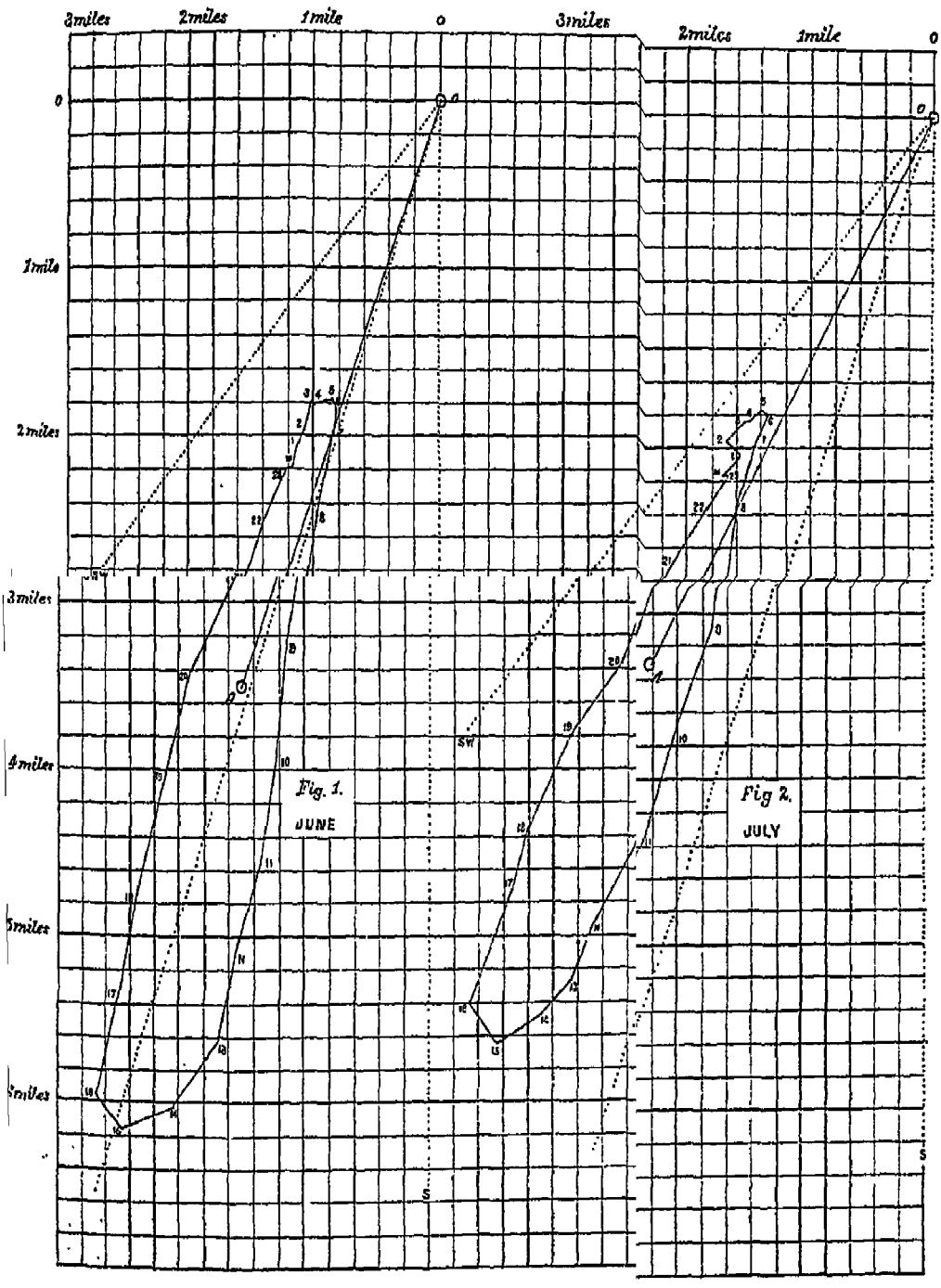
MEAN DIURNAL VARIATION OF THE WIND AT RANGOON IN JANUARY, FEBRUARY AND MARCH SHOWING THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS.



MEAN DIURNAL VARIATION OF THE WIND AT RANGOON IN APRIL AND MAY SHOWING THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS.

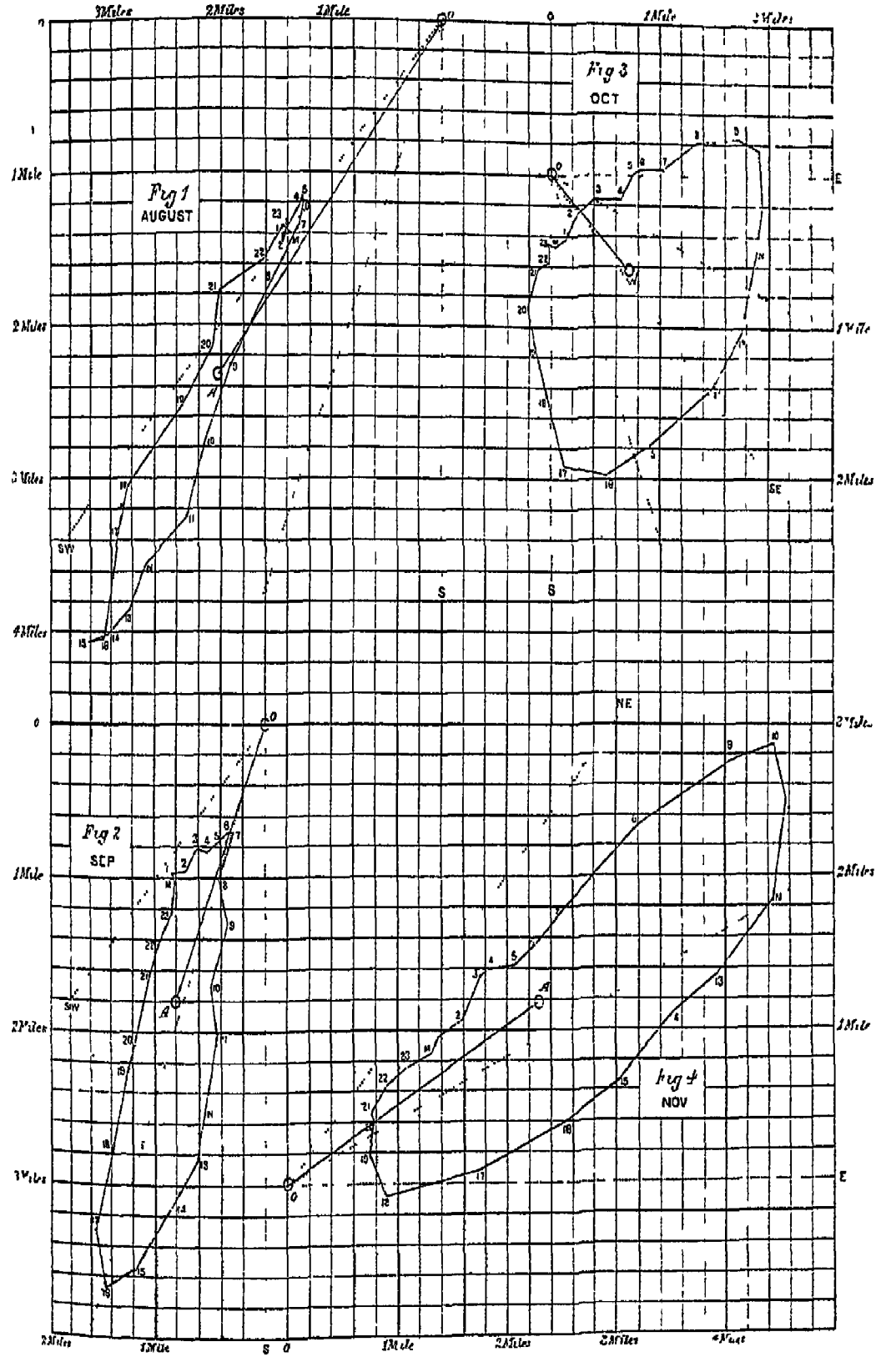


MEAN DIURNAL VARIATION OF THE WIND AT RANGOON IN JUNE AND JULY SHOWING THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS.



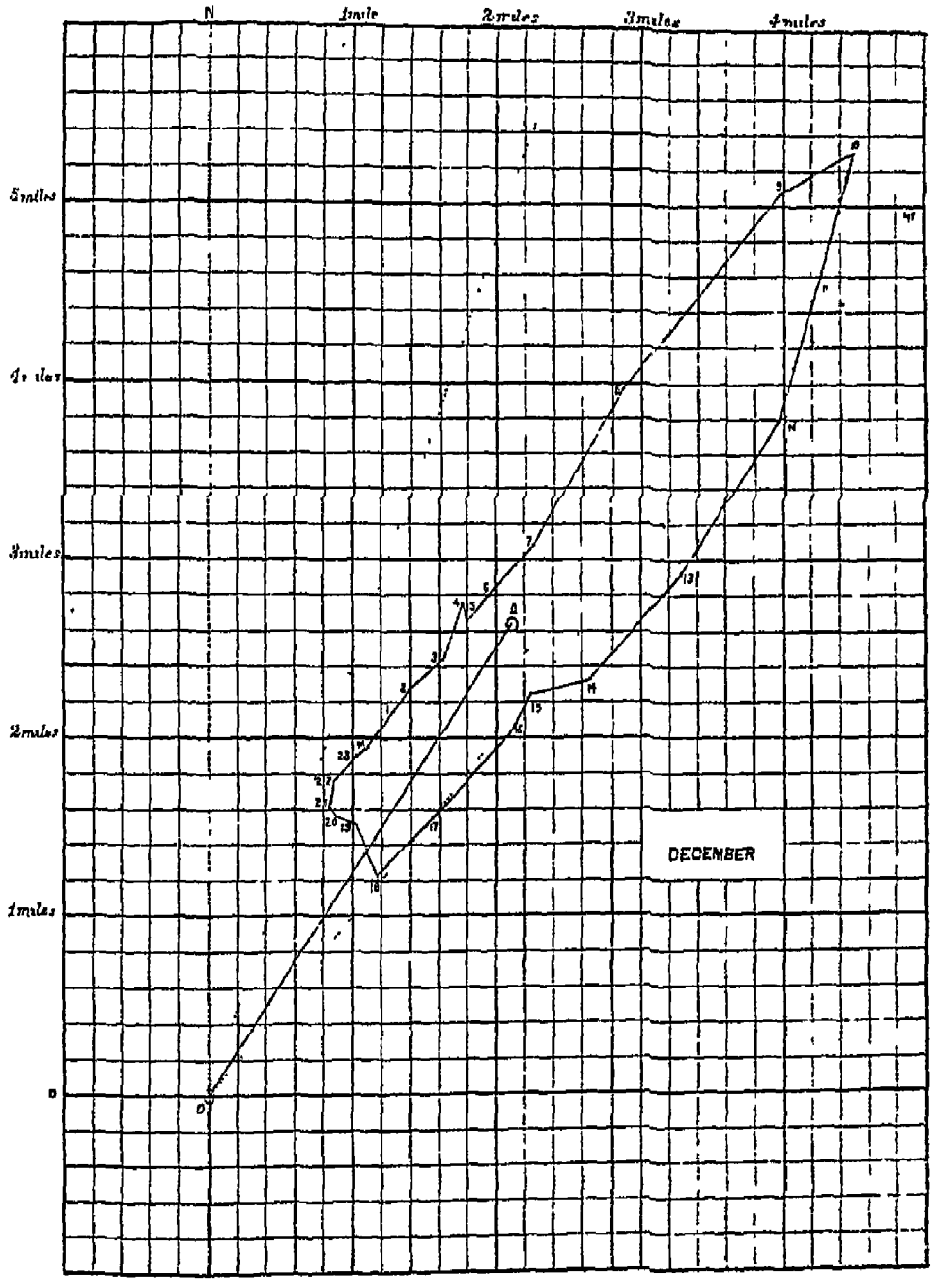
LITHO, BY S.B. MUKERJI.

MEAN DIURNAL VARIATION OF THE WIND AT RANGOON IN AUGUST SEPTEMBER, OCTOBER AND NOVEMBER SHOWING THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS.

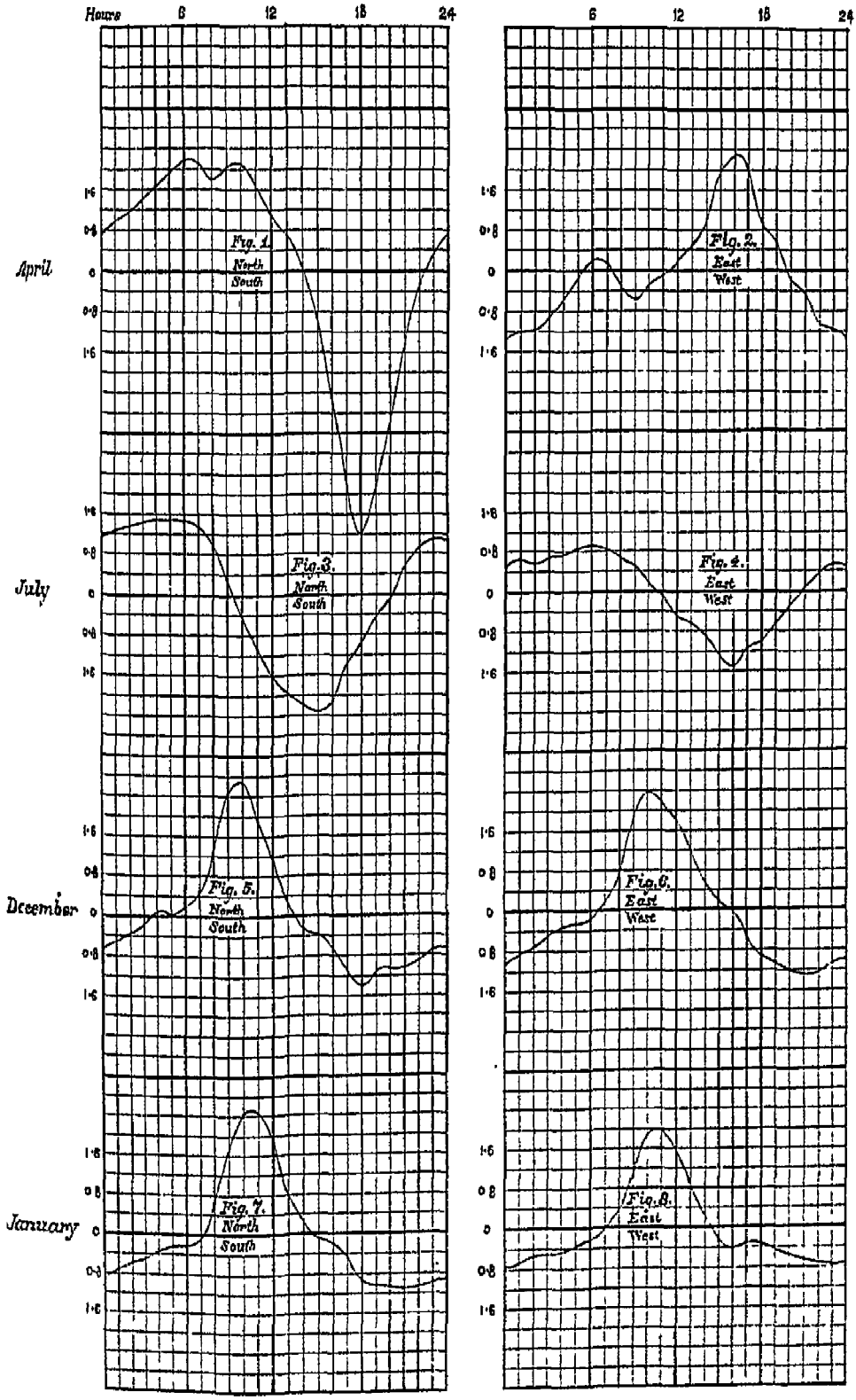


LITHO BY S E WONDLE

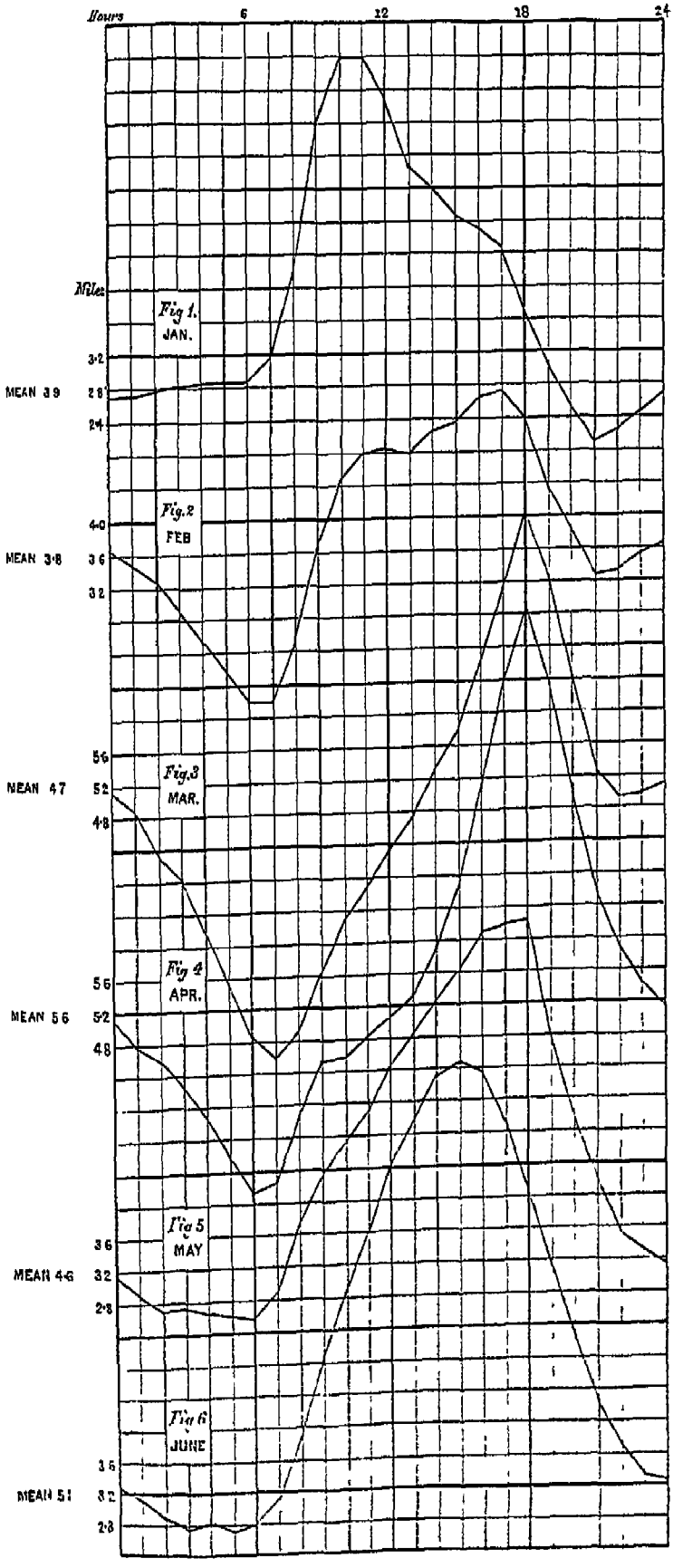
MEAN DIURNAL VARIATION OF THE WIND AT RANGOON IN DECEMBER SHOWING THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS



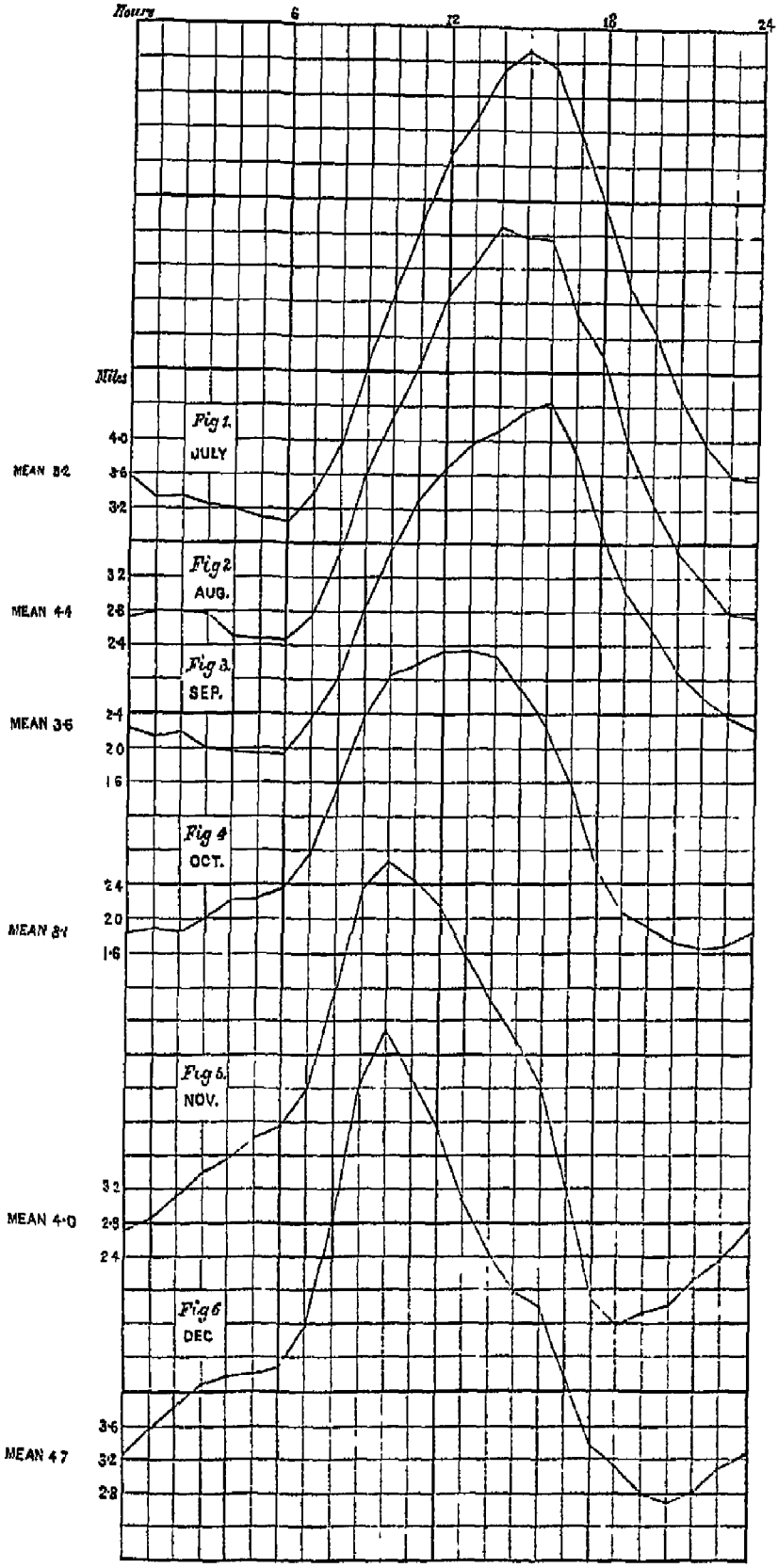
DIURNAL VARIATION OF NORTH-SOUTH AND EAST-WEST COMPONENTS OF THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS AT RANGOON FOR FOUR TYPICAL MONTHS.



MEAN DIURNAL VARIATION OF THE WIND VELOCITY AT RANGOON FOR THE MONTHS JANUARY TO JUNE, SHOWING THE TOTAL AIR MOVEMENT IRRESPECTIVE OF DIRECTION DURING SUCCESSIVE HOURS.



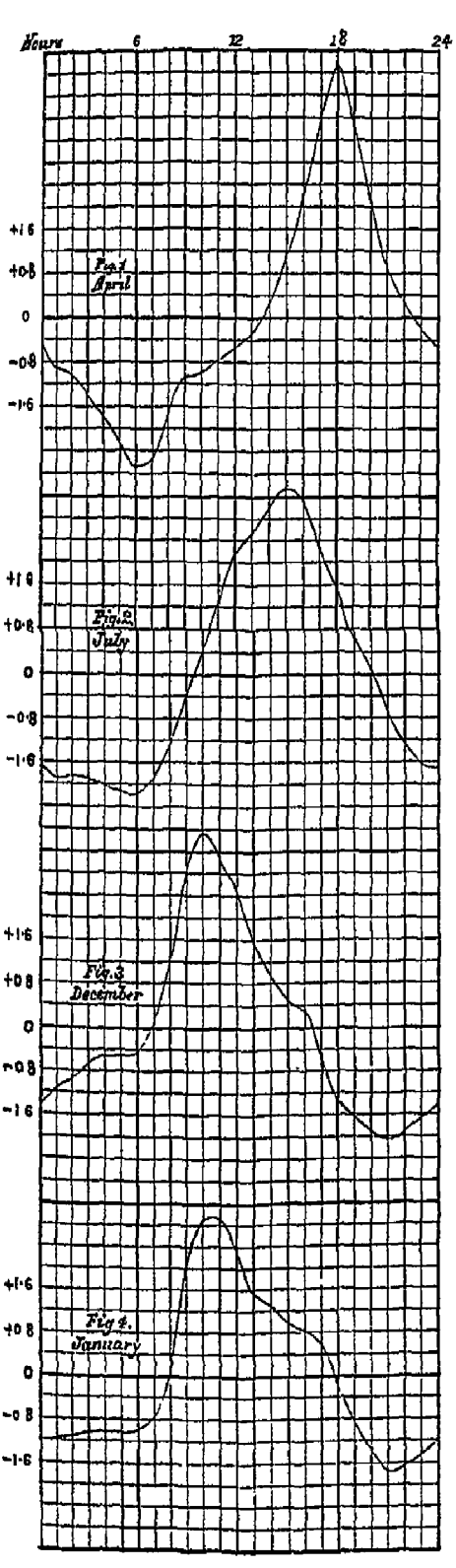
MEAN DIURNAL VARIATION OF THE WIND VELOCITY AT RANGOON FOR THE MONTHS JULY TO DECEMBER, SHOWING THE TOTAL AIR MOVEMENT IRRESPECTIVE OF DIRECTION DURING SUCCESSIVE HOURS.

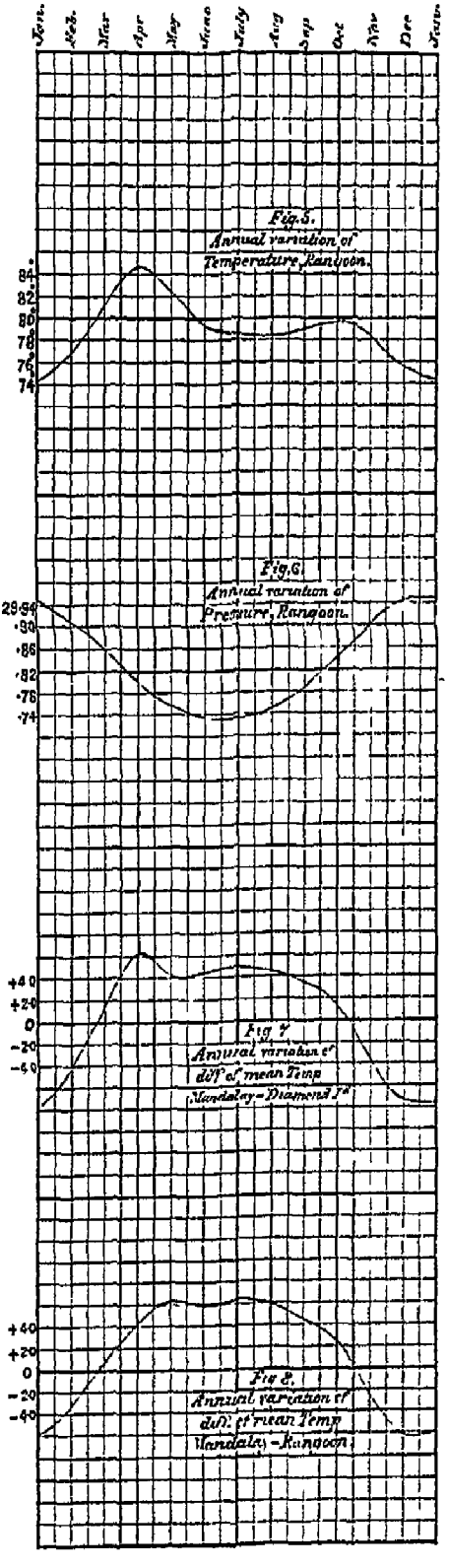


LITHO BY W. S. HUTCH

DAILY VARIATION OF THE WIND VELOCITY FROM THE MEAN IRRESPECTIVE OF DIRECTION AT RANGOON DURING APRIL, JULY, DECEMBER AND JANUARY.

ANNUAL VARIATION OF TEMPERATURE AND PRESSURE AT RANGOON AND OF DIFFERENCE OF MEAN TEMPERATURE, MANDALAY *minus* DIAMOND ISLAND AND MANDALAY *minus* RANGOON.





SITHO BY W. L. WALDEN

II.—*A discussion of the anemographic observations recorded at Chittagong from June 1879 to December 1896 by* Sir John Eliot, M.A., F.R.S., K.C.I.E.

Position of observatory, Long. 91° 50′E., Lat. 22° 21′N. Elevation of anemograph cups above the ground 29 feet 9 inches, and of barometer cistern 86·7 feet above mean sea-level.

Description of station.—The following description of the position and surroundings of the observatory at Chittagong is taken from the late Mr. Blanford's "Discussion of the hourly observations recorded at Chittagong" (Indian Meteorological Memoirs, Vol. IX, Part I).

"Chittagong is situated in the extreme north-east corner of the Bay of Bengal, in nearly the same latitude as Calcutta, on the coast of the Arakan main-land, just outside the embouchure of the Megna estuary. Its port is formed by the Karnaphuli river, a small stream that descends from the northern ridges of the Arakan Yoma, and enters the Bay a few miles below Chittagong. Four or five miles inland from the coast, the land is a low alluvial flat under rice cultivation, and the station of Chittagong is built on a series of low hills that rise abruptly from this flat, and constitute the broken margin of a more elevated plain that slopes up gradually to the Arakan Yoma. The nearest ridges of this hill range are about 20 miles distant to the east. Thus situated, the station is fully exposed to the south-west monsoon from the Bay, and at all times of the year the climate is comparatively damp.

"From March 1879 to the present time the observatory has been situated at the Telegraph Office, on the summit of one of the low hills above mentioned. The hill is flat topped, and the nearest higher hills are two in number:—One about a furlong to the south which dominates it by a few feet and is crowned by a house and a number of trees, and another half a mile to the north-west. To the east and west there is no obstacle, but the observatory overlooks the alluvial flat, that in the former direction extending up the course of the Karnaphuli, and in the latter stretching between the hills and the sea."

It may be noted that previously to March 1879 the observatory was situated about a mile to the north of the present site, also on a hill of about the same height, but with a somewhat less favourable exposure. The anemographic data (from June 1879 to December 1896) form a continuous series recorded under the same conditions of exposure and observation throughout, and on a site which probably gives a fairly accurate representation of the air movement in the somewhat peculiar position of Chittagong. A reference to the map will show at once some of these peculiarities. The trend of the Arakan coast from Sandoway to Cox's Bazar is from south-east to north-west and that of the Chittagong coast, from Cox's Bazar to Chittagong, is from south to north. Chittagong is about 50 miles further north than Saugor Island, the estuary of the Megna forming a wide open bay. A comparatively short distance to the north of the low rice producing plains of the Chittagong, Noakhali and Comilla districts are the low ranges of the Tipperah hill districts, running east and west. The action of the Arakan coast and background of hills the Arakan Yoma having an average elevation of at least 5,000 feet) deflects the monsoon it over the eastern half of the Bay from north-east to north-west. This deflection in

the north-east angle of the Bay is accentuated by the Tipperah and Assam Hills to the north, with the result that Chittagong is to a certain extent in a "back water" with respect to the south-west monsoon current. Hence the movement during the period of the south-west monsoon is much less vigorous than at Saugor Island in the north-west angle of the Bay. Mr. Blanford says on this point "The Chittagong district is very broken and the observatory is situated on a small hill with no higher elevation near it, so that the exposure is as satisfactory as is possible under the circumstances. At a short distance from the coast rise up the ranges of the Chittagong Hill Tracts and of the South Lushai Hills, the central ridges of which attain an elevation of 6,000 feet and 7,000 feet Chittagong is hence from its position partially protected from the general air movement of the two monsoon seasons of the year in Bengal and the north of the Bay."

The effect of the deflection on the strength of the south-west monsoon winds is shown most strikingly by the contrast of the mean wind velocity from July to September at stations on the east and west coasts of the Bay north of Lat. 16° N.

Stations on the east coast of the Bay.	Mean air movement of the period, July to September.	Stations on the west coast of the Bay.	Mean air movement of the period, July to September.
	Miles.		Miles
Port Blair (on east side of Island)	254	Madras	166
Diamond Island	218	Masulipatam	178
		Cocanada	180
Akyab	82	Gopalpur	264
		False Point	235
Chittagong	144	Saugor Island	317

The deflection of the south-west monsoon current, due to topographical conditions, is hence a factor that must be kept steadily in view in considering the wind data of Chittagong.

From its position it is also to some extent shielded during the cold weather from the north-westerly movement in Bengal which is, during that season, the continuation of the drift of the lower atmosphere down the Gangetic plain.

The air movement is comparatively feeble in the hot weather at Chittagong as it is also at Silchar and other stations near the hills in East Bengal and Cachar. There is during that season a very strong indraught from the adjacent sea area of the north of the Bay into the Gangetic delta giving vigorous south-west and south winds over the greater part of Bengal. In east Bengal and Cachar, near the hills, there is much forced ascent, which gives rise to frequent thunderstorms with heavy showers. The total rainfall of this period is hence large in amount, and diminishes with distance in southerly and westerly directions from the hill ranges. This peculiarity is well shown by the following rainfall data for the month of May of four series of stations on lines running

north and south from the foot of the hills westwards, and at distances of about a degree (60 miles) from each other :—

Stations in mean Long. 91½° E.	Average total rainfall for the period, March to May.	Stations in mean Long. 90½° E.	Average total rainfall for the period, March to May.	Stations in mean Long. 89½° E.	Average total rainfall for the period, March to May.	Stations in mean Long. 88½° E.	Average total rainfall for the period, March to May.
	Inches.		Inches.		Inches.		Inches.
Chittagong .	16·29	Barisal . .	13·51	Khulna . .	11·27	Saugor Island .	6·97
Noakhali .	17·48	Madaripur .	14·28	Jessore . .	13·57	Calcutta (Alipore)	5·28
Comilla . . .	19·95	Dacca . .	17·39	Faridpur . .	15·08	Krishnagar .	10·10
Sylhet . .	42·00	Mymensingh .	19·73	Sirajganj . .	12·16	Berhampore .	7·65
Silchar . . .	37·21			Bogra . .	12·45		
Mean of all stations.	26·59	Mean of all stations.	16·23	Mean of all stations.	12·91	Mean of all stations.	8·26

The chief features of the precipitation of the period in that area are, rapid increase on proceeding from the coast towards the hills, and moderate decrease in proceeding westwards from the east Bengal hills to central Bengal.

Data.—The data under discussion were tabulated from the anemograms obtained from a Beckley's anemograph by Casella. The instrument was received from London in January 1878 and was shortly after placed in position. It was in use from June 1879 to December 1896. Numerous short interruptions occurred chiefly due to stoppage of the clock. The observations appear to be fairly satisfactory, except for one short period, when for some reason the instrument failed to record properly.

Summaries of the tabulated data are given in Tables 1 to 6, Appendix B. Table 1 gives the mean movement of the air (irrespective of direction) for each hour of the mean day of each month of the year and for the whole year. Table 2 furnishes the number of winds recorded under each octant of the compass at each hour of the day in each month of the year and Tables 3 and 4 the number of miles of wind recorded under each octant of the compass at each hour of the day of each month and in each month of the year. Table 5 gives the components in the north and east directions of the air movement during each hour of the mean day of each month ; and Table 6, similar data for each hourly interval of the mean day of the year, and these data smoothed by the harmonic formula.

In Plates XV to XXVII, following the Appendix, Table 6, are given curves plotted from the data of the tables in the Appendix or from the original data. Plates XV and XVI give wind roses for each month, showing the percentage of calms and the mean amount of wind in each direction, by means of vectors the lengths of which are proportional to the percentage amount of wind from that direction to the total air movement of the month Plates XVII and XVIII give curves showing the annual variation of the air movement, and of the diurnal variation on the mean of the year. Plates XIX to XXIV contain curves

period, October to February, and also for the month of November at Chittagong, together with similar data for Calcutta for comparison:—

Hour	Percentage of calms to total wind observations at Chittagong for each hour of period		Percentage of calms to total wind observations at Calcutta for each hour of the period	
	October to February	November.	October to February	November.
0	41	47	35	34
1	39	43	35	33
2	39	43	33	33
3	36	42	32	30
4	32	36	31	29
5	33	38	30	27
6	32	34	31	27
7	29	30	31	27
8	21	21	24	21
9	10	9	12	7
10	5	5	3	2
11	3	4	1	1
12	2	4	1	1
13	2	4	0·5	1
14	2	4	1	1
15	2	4	1	1
16	4	9	2	2
17	13	23	5	8
18	28	36	28	29
19	31	35	38	37
20	35	44	37	37
21	38	43	36	37
22	41	47	36	39
23	43	49	35	38

The diurnal distribution is hence similar at these stations. Calms are comparatively rare from 10 A.M. to 4 P.M. They increase rapidly during the next two hours and thence slowly up to the maximum at 11 P.M. They diminish slowly in number thence to 7 A.M. and very rapidly during the next two hours.

B. Steadiness.—The steadiness of the air movement is on the whole greater than might be expected from the position and exposure of the observatory.

The following gives data :—

Month.	Percentage steadiness of the air movement from observations of		Variation of the steadiness of the air movement at Chittagong from that of			
			Saugor Island.		Calcutta.	
	Direction only.	Movement.	Direction.	Movement.	Direction.	Movement.
	α	β	α	β	α	β
January	41	47	+21	+21	+ 6	− 7
February	29	31	+ 9	+ 7	+ 2	− 6
March	30	51	−35	−23	−20	−13
April	50	64	−31	−21	−18	−13
May	50	59	−26	−22	−13	−12
June	68	73	0	− 3	+ 8	+ 9
July	75	79	+13	+ 8	+19	+21
August	70	79	+ 7	+ 8	+18	+25
September	45	60	− 6	0	+ 4	+13
October	11	1	0	− 7	+ 3	− 9
November	38	46	−21	−19	−15	−33
December	45	56	−15	−12	−10	−34

Winds at Chittagong are most variable in October. They are also unsteady in February and March. The percentage of steadiness is large in the south-west monsoon period or rainy season, considerable in the hot weather, and moderate from November to March.

A comparison with the corresponding data for Calcutta and Saugor Island shows that the air movement during the south-west monsoon is considerably steadier at Chittagong than at these two stations. This is, of course, mainly due to the very slight modification of direction or shift of the winds at that station during the cyclonic storms of the period as compared with those two stations.

The air movement is, on the other hand, much more variable at Chittagong in the months of November and December and also in the hot weather months, March to May.

The following table gives the largest amount or absolute maximum amount of wind

recorded in 24 hours in each month of the year and the average of the maximum amount of each year :—

Month.	Absolute Maximum (a)	Mean Maximum	Mean wind velocity. (b)	Ratio of (a) to (b)
January	119	87	49	2·4
February	221	119	60	3·7
March	395	235	107	3·7
April	334	279	154	2·2
May	389	267	135	2·8
June	297	268	151	2·0
July	328	258	153	2·1
August	285	225	130	2·2
September	268	178	85	3·1
October	476	163	48	9·0
November	267	95	40	6·6
December	158	65	41	4·0

The ratio data given in the last column differ little from 2·5 except in the case of the months of October, November and December, when cyclonic storms occasionally give very severe winds.

C. Direction.—The following table gives the mean direction of the winds at Chittagong, first by Lambert's method in which equal values are given to each wind, and secondly by combining them according to the parallelogrammic law, in which the amount of wind in each direction is taken into account :—

Month.	Mean resultant from observations of	
	Wind direction	Air movement
January	N 36° W	N 45° W
February	N 60° W	N 85° W
March	S 23° W	S 17° W
April	S 4° W	S 7° W
May	S 7° E	S 4° E
June	S 21° E	S 19° E
July	S 20° E	S 18° E
August	S 17° E	S 15° E
September	S 11° E	S 10° E
October	N 17° W	S 10° E
November	N 28° W	N 33° W
December	N 32° W	N 36° W

The mean air movement is from north with increasing westing during the period of land winds from October to February (*vide* Fig. 1, Plate XVII). The following shows the change from month to month :—

Month.	Mean wind direction.	Change of wind direction from that of previous month	Mean direction of air movement.	Change of direction of air movement from that of previous month.
November	N 28° W	+11° W	N 33° W	.
December	N 32° W	+ 4° W	N 36° W	+ 3° W
January	N 36° W	+ 4° W	N 45° W	+ 9° W
February	N 60° W	+24° W	N 85° W	+40° W

The mean wind direction during the period is N 39° W. It shifts in the westerly direction throughout the period, by a total amount of 32°. This shift is due to the increasing influence of the cold weather conditions of the period. It is common to the whole of Bengal (*vide* discussion of the winds of Calcutta and of Saugor Island) and also extends into Upper and Central Burma.

The winds shift round to southerly directions as a rule in the last week of February. During the hot weather months, winds are from southerly directions with decreasing westing or increasing easting during the period, as shown below :—

Month.	Mean or resultant wind direction	Change from previous month	Mean or resultant direction of air movement.	Change from previous month
March	S 23° W	...	S 17° W	...
April	S 4° W	−19° W	S 7° W	−10° W
May	S 7° E	−11° W or +11° E	S 4° E	−11° W or +11° E

The mean wind direction of the period is S 7° W, and hence parallel to the lie of the coast and hills of the Chittagong district. The westerly component decreases in influence during the period and is in May replaced by a very feeble easterly element. The deflection is hence opposite to that of the preceding period but is in the same direction as at Calcutta and Saugor Island.

During the south-west monsoon months the mean winds are from south with moderate easting, decreasing slightly with the advance of the season from July to September, but chiefly in the last month, as is seen from the following :—

Month.	Mean or resultant wind direction.	Change from previous month.	Mean or resultant direction of air movement.	Change from previous month
June	S 21° E	+14° E	S 19° E	+13° E
July	S 20° E	− 1° E	S 18° E	− 1° E
August	S 17° E	− 3° E	S 15° E	− 3° E
September	S 11° E	− 6° E	S 10° E	− 5° E

Both methods of calculation of direction hence give almost exactly the same results The slight change of the wind direction during the period is hence opposite in sense to that of the hot weather.

VARIATION OF THE MEAN AIR MOVEMENT DURING THE DAY.

Velocity.—The diurnal variation of velocity is very marked during the greater part of the year. The data will be found in Table 1 of Appendix B and the curves plotted from the data for each month in Plates XXV and XXVI.

Cold weather period.—The diurnal variation is slight to moderate in amount in the season of north-west or land winds from October to February. The air movement is greatest at 3 P.M., falls slightly during the next hour and then rapidly until 6 P.M., when an abrupt change occurs in the decrease of velocity. It falls very slowly until 10 P.M. or 11 P.M., thence rises slowly but steadily until 8 A.M., and thence more rapidly until 10 A.M. From 10 A.M. to 1 P.M. it is almost unchanged in the months of October, November and December or rises slightly in January and February, and from 1 P.M. it increases rapidly until 3 P.M., the epoch of maximum movement. The anomalous feature of nearly uniform velocity from 10 A.M. to 1 P.M., usually the period of most rapid increase, present in the October, November and December curves, is not shown in January and February. As the air movement is practically from the same direction during the whole period, it is not possible that this feature can be due to local peculiarities of exposure of the wind instrument. It is hence without doubt a peculiarity of the air movement of the period October to December which requires explanation. It may be noted here that a similar retardation or brief diminution of the rate of the morning increase of velocity is shown in the curves for April, May and June.

Hot weather.—The diurnal variation is most marked and largest in amount in the hot weather months, and is absolutely greatest in April.

The maximum movement is at 3 P.M. in March and April and at 2 P.M. in May. The velocity then decreases very slightly until 4 P.M. after which it falls rapidly until 7 or 8 P.M. and thence slowly and somewhat irregularly to the minimum of the day at 5 A.M. It thence increases more or less rapidly until noon or 1 P.M. and from that hour slowly until the epoch of the maximum at 2 P.M. or 3 P.M. The May and April curves show a noteworthy diminution in the rate of increase of velocity from 8 A.M. to 10 A.M. during the period of increasing temperature.

South-west monsoon period.—The diurnal variation is of the same type throughout the south-west monsoon months from June to September. The chief features of the mean air movement of the period are that it decreases to a moderate extent throughout the period and that the amplitude of the diurnal variation decreases *pari passu*, the ratio between the arithmetical values of these two elements being almost constant for the period. The data illustrating this will be found in the table on page 78.

The diurnal variation during this period is very similar in character to that of the preceding or hot weather season, and is in fact of the same general type.

The maximum air movement during the day occurs at 3 P.M. in all months of the period except in June when it is at 2 P.M. It decreases slightly until 4 P.M. and thence rapidly until 8 P.M. when the rate or decrease changes abruptly and largely. The movement diminishes slowly but irregularly during the night until 5 A.M. (or 6 A.M. in June) when it is absolutely least. It thence increases more or less rapidly until 2 P.M. and thence slightly to the maximum. There is exhibited in every month a short temporary diminution of the rate of increase during the morning hours from 8 to 10 A.M. This feature, it may be noted, to a less marked extent at Saugor Island.

The diurnal variation of the air movement at Chittagong hence belongs to two types, *viz.*, that of the dry season of north-west winds and that of the damp period of southerly sea winds.

The maximum occurs at about the same instant throughout the whole year, *viz.*, at 3 P M. or about an hour to an hour and a half after the instant of maximum temperature at Chittagong (but not of the interior of Bengal). The chief difference between the diurnal variation of the two periods is that in the dry period the epoch of the minimum is early in the evening from 7 to 10 P.M. and in the damp period about sunrise and nearly coincident with the period of minimum temperature in the diurnal variation. Air movement is practically constant in amount or increases slightly during the night period from 10 P.M to 7 A.M. in the dry season of northerly winds and decreases to a moderate extent in the same period of the day, during the season of damp southerly winds. The Calcutta and Saugor Island data show that a similar contrast obtains at these stations.

The most remarkable feature in the diurnal variation of the air movement at Chittagong is a marked temporary diminution of the morning rate of increase of velocity during a brief period, usually from 8 to 10 A.M. Another noteworthy feature is a comparatively abrupt diminution of the evening decrease of velocity for a brief period during the evening. These features are exhibited by the data of the following table giving the hourly change of velocity for the mean day of the year and of four typical months.

Hour	Mean hourly change of velocity for the mean day of				
	Year.	January	April	July.	November
Midnight to 1 hour	−0·06	+0 12	−0 25	−0 40	+0 10
1 hour „ 2 hours	−0 07	+0 11	−0 23	−0·15	−0·05
2 hours „ 3 „	−0 09	+0·02	−0 31	−0 30	+0 05
3 „ „ 4 „	+0 04	+0 05	−0 06	+0 05	+0 09
4 „ „ 5 „	−0 08	−0 01	−0 19	−0 25	−0 02
5 „ „ 6 „	+0 07	+0 15	+0 20	+0 04	+0·06
6 „ „ 7 „	+0 32	+0 03	+0 57	+0·56	+0·06
7 „ „ 8 „	+0 72	0	+1 53	+0 95	+0 33
8 „ „ 9 „	+0 38	+0 46	+0 56	+0 39	+0 47
9 „ „ 10 „	+0 38	+0 26	+0 59	+0 47	+0·28
10 „ „ 11 „	+0·79	+0 30	+1 81	+1·22	+0·16
11 „ „ Noon	+0 53	+0 23	+1 07	+0 63	−0 03
Noon „ 13 hours	+0 53	+0·41	+0 85	+0 49	+0·22
13 hours „ 14 „	+0 57	+0 89	+0 11	+0 40	+0 55
14 „ „ 15 „	+0 24	+0 63	+0 09	+0 03	+0 53
15 „ „ 16 „	−0·17	−0 05	−0 37	−0 01	−0 31
16 „ „ 17 „	−1 02	−1·30	−1·00	−0 57	−1 30
17 „ „ 18 „	−1·19	−1·51	−1 63	−0 07	−0 55
18 „ „ 19 „	−0 80	−0 17	−1 66	−1·13	+0 12
19 „ „ 20 „	−0·48	−0·10	−1 03	−0 72	−0 27
20 „ „ 21 „	−0 22	−0 29	−0 27	−0·39	−0 16
21 „ „ 22 „	−0 18	−0 17	−0 18	−0 ·8	−0·23
22 „ „ 23 „	−0 ·3	−0 09	+0 08	−0 47	+0 02
23 „ „ Midnight	−0·08	+0 03	−0 28	+0 01	−0 09

The following are the chief inferences from the preceding data:—

(1) The air movement commences to decrease in amount at about 3 P.M. in all seasons.

(2) The decrease is rapid from about 4 P.M. to 6 P.M. in the cold weather, and from 4 P.M. to 7 to 8 P.M. in the hot weather and rainy seasons.

(3) The decrease is small and somewhat irregular in amount during the night.

(4) The air movement begins to increase at 5 A.M. The rate of increase is moderately large from 6 A.M. to 8 A.M.

(5) From 8 A.M. to 10 A.M. the rate of increase is much smaller than during the preceding two hours or succeeding three hours more especially.

(6) The rate of increase of air movement during the day is greatest during the cold weather from 1 P.M. to 3 P.M. and during the hot weather and rains from 6 A.M. to noon.

(7) The differences between the diurnal variation of the air movement in the short season of dry land winds and the long season of damp sea winds are less pronounced at Chittagong than at Rangoon.

The following table gives a comparison of the mean daily air movement and the amplitude of the diurnal variation:—

Month	Mean hourly movement. (a)	Amplitude of diurnal variation (b)	Ratio (b) : (a).
January	20	37	1·9
February	25	45	1·8
March	45	59	1·3
April	·64	74	1·2
May	5·6	58	10
June	63	55	09
July	65	5·2	08
August	54	52	10
September	3·5	45	13
October	20	27	14
November	17	28	16
December	17	28	16

The ratio is much larger for the period of the land winds than for that of the sea winds. It averages 1·6 for the period, October to February, and 1·0 for the period, April to September. Hence relatively to the actual mean movement the diurnal variation is larger and more important in the former than the latter period—Chittagong agreeing in this respect with Calcutta and Saugor Island.

Diurnal rotation or variation of direction of air movement.

The data are given in Table 5 of the Appendix In this table the data for each month are resolved in the northerly and easterly directions and the average total components to these directions of the air movement at each hour are given. The average hourly movement for the whole day is given in the lowest horizontal row, and may be assumed to

represent the movement due to the general pressure conditions of the period. When this is applied (with the opposite sign) as a correction to the hourly values, the residuals in the two directions form series which, when plotted with a common origin and axes at right angles to each other, give curves that represent the variation in direction and amount during the day—due to the varying diurnal actions and conditions.

The year.—The variation of the components in the northerly and easterly directions for the mean day of the year is shown by the curves, Figs. 1 and 2, Plate XVIII, and of the velocity (irrespective of direction) for the mean day of the year in Fig. 3 of the same plate. Plate XVII, Fig. 5, is plotted from the actual means and Fig. 6 from the means smoothed by the application of the harmonic formula. The curves are elongated narrow ovals with their axes lying E. N. E. and W. S. W. and hence approximately at right angles to the coast and interior ranges of hills.

The mean diurnal rotation as exhibited by the two curves indicates a feeble flow from north and east during the night and morning hours, and a much stronger flow from south and west during the day hours from 10-30 A.M. to 7-30 P.M. The chief feature of the movement is probably in part at least due to an alternating movement between the sea and the Chittagong coast district and hills. The northerly movement on the mean of the year is greatest at about 4 A.M. and the southerly element at about 3 P.M. The easterly component is a maximum from 9 A.M. to 10 A.M. and the westerly element 3 P.M. to 4 P.M. or at the hottest time of the day.

The diurnal rotation varies considerably in character during the year. An examination of the monthly curves, Plates XIX to XXIII, shows that they may be arranged under two types. The first type is for the period of land winds from October to February. The diurnal rotation of the remaining seven months belongs to the second type.

A reference to the curves in Plate XVIII shows that the epoch of the maximum air movement is coincident with the maximum movement from the southerly and westerly directions. The minimum movement also agrees in its epoch with the maximum northerly movement, but precedes the epoch of the maximum easterly movement by about five hours.

Cold weather.—The curves for the period October to February are complex, consisting of two or more loops and form very narrow elongated figures, the axes of which are approximately in an E. N. E. to W. S. W. direction. Hence the chief feature of the diurnal rotation in this period is an alternating movement from west and east. The easterly movement is greatest in the morning hours from 9 to 10 A.M. in October, and from 10 A.M. to 11 A.M. in November, December, January and February, that is in the morning about the time of most rapid increase of temperature in its diurnal variation in Bengal. The westerly movement is restricted to the afternoon hours from about noon to 8 P.M. and is most vigorous from 3 P.M. to 4 P.M. throughout the period. The most important and largest loop of the curve is that which corresponds to the afternoon and evening hours. This loop is described in the retrograde direction. The alternating northerly and southerly movements are feeble. The latter is strongest at about 10 P.M. or 11 P.M. and the former in the morning at about 10 A.M.

In Figs. 3 and 4, Plate XXVII, are given curves representing the variation of the northerly component of the diurnal rotation, and in Figs. 7 and 8 of the same plate similar curves for the easterly component for the months of December and January. These curves are of considerable interest.

The curves for the easterly component (Figs. 7 and 8, Plate XXVII) are similar in form to those for April and July and indicate clearly that the variation of this element is constant in general character during the whole year and is quite independent of the general seasonal changes. They vary slightly in the epochs of the maximum and minimum values, and largely in the amplitude of variation. The variation in that direction probably represents a diurnal alternating movement between the Chittagong hills (averaging 6,000 feet in their higher elevations) and the low ground of south-east Bengal and the adjacent sea area.

The chief features indicated by the curves for the variation of the east component are:—

(1) A short oscillatory variation of the easterly movement between 8 A.M. and noon giving rise to a hump or shoulder of some interest in the curves

(2) An increasing movement from the west between noon and 3 P.M., followed by a decreasing movement until 8 P.M. or 9 P.M.

(3) A movement from the east during the period 10 P.M. to about noon, very feeble in amount from 10 P.M. to 7 A.M.

The comparison of the curves, Figs. 3 and 4, Plate XXVII, representing the variaion of the northerly component for December and January with those of Figs. 1 and 2, for April and July show that the variation of this component in the cold weather is not only small in amount but inverse in general character to that of the hot weather and rains. There is a very feeble southerly component during the afternoon and night hours from about 1 P.M. to about 2 A.M. on the average of the period The northerly component increases from about 7 A.M. to 10 A.M. and then decreases until 1 P.M. The variation is, however, small in amount and apparently of little importance. It represents the slight variation at Chittagong of the diurnal air movement in that direction due to the changes of the thermal relations between north-eastern India and the Bay.

Hot weather and rainy seasons.—The diurnal rotation of the air movement of the remaining seven months, the season of southerly sea winds, is of one type, and is large in amount and very clearly defined. The curves representing the rotation for these months are given in Plates XIX to XXIII. They are all elongated oval curves, with their longes axes running in a general north-east and south-west direction, but with the easterly and westerly elements decreasing in importance with the season. The following gives approximately the direction or lie of the longer axis for each month, and a comparison with the mean wind direction:—

Month	Approximate lie of axes of curves	Mean or resultant wind direction	Angle between
March	S 68° W to N 68° E	S 17° W	129° or 51°
April	S 66° W „ N 66° E	S 7° W	121° „ 59°
May	S 64° W „ N 64° E	S 4° E	112° „ 68°
June	S 54° W „ N 54° E	S 19° E	107° „ 73°
July	S 45° W „ N 45° E	S 18° E	117° „ 63°
August	S 51° W „ N 51° E	S 15° E	114° „ 66°
September	S 60° W „ N 60° E	S 10° E	110° „ 70°

The data of the last column show that the mean difference of the two directions is 60°. The acute angle between the directions increases during the hot weather from 51° to 68° and is nearly constant during the rains, averaging 69°.

The general shift of the axes corresponds with the change of the mean direction or more strictly with that of the easterly element in the southerly sea winds of the period, and is throughout nearly at right angles (more exactly about 69°) to the mean wind direction. The curves are all described directly or clock-wise. The easterly element of the diurnal rotation obtains on the average of the period from 8 P.M. to noon, and is strongest from 8 to 10 A.M. The westerly element prevails during the remaining eight hours of the day from noon to 8 P.M. and is most vigorous from 3 to 4 P.M. These epochs, it will be observed, are the same as in the corresponding alternating movement in the dry season.

The alternating movement from the north and south directions is as strongly marked as the east and west movement. The northerly element obtains from about 8 P.M. to 10 A.M. and is strongest in the early morning about sunrise, *i.e.*, from 5 A.M. to 6 A.M. The movement from the south obtains from 10 A.M. to 8 P.M. and is greatest from 1 P.M. to 3 P.M. and hence during the hottest period of the day.

The season of sea-winds may be divided into the hot season from March to May and the rainy season from June to September.

In Figs. 1 and 5 of Plate XXVII are given curves representing the variation of the northerly and easterly components of the diurnal rotation for the month of April, most fully representative of the hot weather conditions.

The curve, Fig. 1 of that plate, shows that there is a northerly component from 7 P.M to 9 A.M., and that it varies little in amount or intensity during the night hours from 9 P.M. to 5 A.M., when it has its maximum value. It increases rapidly from 7 P.M. to 9 P.M. and decreases as rapidly from 6 A.M. to 9 A.M. The component is southerly from 9 A.M. to 7 P.M., reaching its maximum southerly value at 1 P.M. This curve represents the large variation due to the heating of the land interior of northern India relative to the sea area of the Bay and its relative cooling during the night. The amplitude of this movement is, as might be expected from the temperature conditions, greatest in April.

The curve, Fig. 5 of Plate XXVII, representing the variation of the easterly component, is of the same type as that of the corresponding cold weather variation with practically the same epochs but with much greater amplitude of variation. There is a small oscillatory variation between 5 and 9 A.M due, so far as can be judged, to some special local conditions. This component is zero and changes sign about 9 A.M. and there is a well marked westerly element from 11 A.M. to 8 P.M. greatest in amount at 2 to 4 P.M. during the hottest period of the day. The amplitude of the variation of this element in April is too large to admit of its being explained by an alternating action between the Chittagong hills and plains and the adjacent sea area and it is hence probably in part due to a general effect of the day increase of the air movement of the period down the Gangetic plain and across west and Central Bengal.

The following table gives the total amplitude of this variation in the east and west direction throughout the year :—

	Month	Amplitude east and west direction.
		Miles.
Cold Weather	November	2·84
	December	3·61
	January	4·34
	February	4·41
Hot Weather	March	6·03
	April	6·89
	May	5·76
Rainy Season	June	4·10
	July	3·87
	August	4·27
	September	4·23
	October	2·78

Figs. 2 and 6 in Plate XXVII give curves representing the northerly and easterly components of the diurnal rotation for the month of July, representative of the rainy season. The curve for the northerly component closely resembles that for April. The component is north or positive from 8 P.M. to 10 A.M. and is greatest at 5 A.M. It is negative or south during the remainder of the day, being a maximum from 2 to 4 P.M. The amplitude of this oscillatory variation is practically the same during the two months representative of the hot and rainy seasons. The alternating movement in this direction is evidently due to the same general action in these two months representative of the two periods, *viz*, the general variation of the air movement over northern India and the Bay due to the variation of the thermal gradients during the day. It is probable that this large movement in the rainy season may be in part a result of the condensation of aqueous vapour, greatest in the day hours.

The curves representing the easterly movement, show that the movement is from east between 7 P.M. and 11 A.M. (being greatest at 9 A.M.) and from west during the remainder of the day (being greatest at 2 P.M.). The amplitude of this movement is considerably less in July than in April.

The following is a summary of the chief features of the diurnal rotation of the winds, and of the accompanying pressure, temperature and aqueous vapour variations for each season of the year :—

Cold weather, or season of dry north-westerly winds, November to January, preceded and followed by the transitional months of October and February.

The mean wind direction in Bengal during this period is approximately north-west, determined by the mean pressure and other conditions in northern India. One of the

most important of these is the westerly flow down the Gangetic plain, feeble in Upper India and moderate in north-east India, but varying considerably in strength during the day, due to the varying temperature and pressure conditions and relations between northern India and the adjacent seas.

The day may be divided up into four periods. The following describes the more important features of these periods at Chittagong:—

First period, from 10 P.M. to 6 A.M. The air movement increases very slightly, the northerly and easterly elements both increasing. The changes occur slowly during this period, and the wind throughout this as during the remainder of the day is from some northerly direction. Temperature decreases steadily but slowly throughout the period, and pressure decreases until 4 A.M., when it begins to increase. The amount of aqueous vapour present in the air also decreases slowly but steadily throughout the period parallel with the temperature, but not with the pressure variation.

Second period, from 6 A. M. to 10 A.M. The air movement increases slightly to moderately, and both tho northerly and easterly components increase during the period up to their maximum values. This period is noteworthy as temperature, air pressure and aqueous vapour pressure all increase, the second and third to their maxima day values. The rate of increase of temperature during the day is greatest from 8 A.M. to 10 A.M.

Third period, from 10 A.M. to 4 P.M. The air movement increases rather rapidly up to its maximum daily value at about 2-30 P.M. or the epoch of maximum temperature (1·45 P.M.) This is chiefly due to a rapid increase of strength of the westerly component which attains its maximum from 3 P.M. to 4 P.M. The northerly element, on the other hand, decreases slightly but steadily in strength during the period. The air pressure decreases throughout to a minimum at about 4 P.M. Temperature increases and aqueous vapour decreases from 10 A.M. up to about 2 P.M., and thence commence to change in the opposite manner.

Fourth period, from 4 P.M. to 10 P.M. During this period, the northerly element of the air movement increases slightly in strength whilst the westerly component diminishes rather rapidly. The resultant movement hence decreases rapidly during the first half of the period and then moderately. Temperature decreases during the whole of this period, and the air pressure increases. The rate of decrease of air temperature is moderate to large from 3 P.M. to 8 P.M. and thence diminishes steadily in amount. The aqueous vapour pressure decreases slowly during this interval.

The second period of the year, of southerly sea winds, from March to September.

The day may be divided into four nearly equal periods in considering the various changes accompanying the diurnal rotation of the air movement.

First period, from 4 A.M. to 10 A.M. The air movement is usually least at about 5 A.M. or at about the commencement of the period. It increases slowly until 6 A.M., thence rapidly until 8 A.M. and again rather slowly until 10 A.M. This last feature is pronounced and is of much theoretical importance. The southerly element is least at 4 A.M. (or there is a residual northerly action, greatest at 4 A.M.) and decreases slowly during this interval. The easterly element increases up to a maximum at 10 A.M. on the average of the period. Pressure increases during the period and temperature and the aqueous vapour pressure decrease until about 6 A.M., when both begin to increase. The rate of increase of temperature is large from 8 A.M. to 10 A.M.

The curves for June, July, August and September exhibit a small but noteworthy kink for the period from 8 to 10 or 11 A.M.

Second period, from 10 A.M. to 4 P.M. During this period the velocity increases rather rapidly up to a maximum about 3 P.M. This is chiefly due to a marked increase of the southerly component, and to a slightly less extent of the westerly component. Both of these reach their maximum shortly after the epoch of maximum temperature. The westerly influence is greatest in the hot weather and is then in part due to the action of the Central Burma high temperature area and in part to the strengthening and extension of the westerly movement down the Gangetic plain across Bengal. The strong southerly component in both the hot weather and rainy seasons is due to the action of the Chota Nagpur depression which gives largely increased influx across the head of the Bay during the whole of the period, but greater in the hot weather than in the rains, when the hot weather sink develops into the south-west monsoon trough of low pressure extending from Chota Nagpur into Sind. During this interval pressure decreases, and until about 1 P.M. temperature increases and changes slowly until 3 P.M. or 3-30 P.M.

The aqueous vapour variation is large and marked during the hot-weather period, and inverse to the temperature variation and is due to convective movement accompanying relative dryness of the air in the lower or middle strata. This effect of convective movement is absolutely greatest in April. During the monsoon months, June to August, when there is much cloud and the Bengal ground surface is more or less saturated with moisture, there is little convective action, the aqueous vapour pressure throughout the day hours follows directly, the temperature and wind changes during the month of October, a very slight convective action is shown.

Third period, from 4 P.M. to 10 P.M. The air movement decreases rapidly during this period, and especially from 5 P.M. to 8 P.M., the period of greatest decrement of temperature. This change is due to an almost equally rapid decrease of both the southerly and westerly components. The movement from 8 P.M. to 9 P.M. or 10 P.M. differs little in either direction or amount from the mean of the day.

Fourth period, from 10 P.M. to 4 A.M. The air movement continues to decrease during this period, due chiefly to slow decrease of the southerly component. The easterly element changes only slightly and somewhat irregularly. During this period temperature decreases and pressure increases, whilst the aqueous vapour pressure decreases slowly.

VARIABILITY OF THE AIR MOVEMENT.

The following table gives the mean diurnal air movement for the four seasons of the year and the whole year for each year of the period 1879—1896:—

YEAR.	MEAN DIURNAL AIR MOVEMENT FOR				
	January and February.	March to May	June to September	October to December	Whole year.
1879	?	?	?	64·9	?
1880	75·7	148·8	130·9	62·1	109·0
1881	89·1	146·2	135·7	63·8	100·9
1882	?	?	?	61·7	?

Year.	Mean diurnal air movement for				
	January and February.	March to May.	June to September.	October to December.	Whole year.
1883	76·4	150·6	155·7	61·1	117·6
1884	78·5	154·6	145·6	61·3	115·6
1885	65·4	147·0	160·7	46·6	112·9
1886	?	131·4	146·0	47·9	?
1887	57·2	125·2	134·5	41·8	96·1
1888	43·5	141·7	120·2	24·2	88·3
1889	23·9	115·4	73·5	18·9	62·0
1890	?	105·3	122·5	9·0	?
1891	24·8	107·0	126·8	29·1	80·4
1892	48·4	146·3	129·5	38·6	97·5
1893	52·0	118·2	117·4	34·8	86·1
1894	43·1	123·4	115·3	42·7	88·1
1895	43·1	131·2	127·5	36·9	91·7
1896	53·1	120·8	126·8	33·0	89·6

The data at first sight suggest that the anemograph at Chittagong became less sensitive, due to increasing friction of other resistances, during the last nine years. A comparison with the corresponding data for Saugor Island and Calcutta shows a general agreement in the variation from year to year.

The data are not sufficiently exact or for a long enough period to furnish evidence of periodic variation. They indicate that the air movement at Chittagong was a maximum in 1883-1885 and a minimum from 1889 to 1891.

In the following table are given the number of days in each month in which a total of 200 miles or upwards was registered during the sixteen-year period 1879-1894:—

Month.	Number of days over 200 miles in																	
	1879.	1880.	1881.	1882.	1883.	1884.	1885.	1886.	1887.	1888.	1889.	1890.	1891.	1892.	1893.	1894.	Total.	Annual mean.
January	?	...	...	?	...	...	...	...	...	...	...	...	...	...	...	...	0	0
February	?	...	...	?	...	...	...	...	...	...	...	...	...	...	...	...	0	0
March	?	9	1	?	2	3	5	1	3	3	1	2	...	5	...	3	38	2·7
April	?	9	14	?	2	10	16	9	...	10	5	4	8	8	6	5	105	7·6
May	?	2	1	?	10	6	...	3	6	3	11	2	...	3	4	9	60	4·3
June	?	8	4	?	8	4	13	4	6	1	5	4	3	3	2	7	72	5·1
July	9	4	8	6	8	10	10	8	9	4	Very doubtful.	4	5	7	1	2	95?	6·8?
August	3	...	2	4	2	2	14	3	3	5		1	3	2	6	...	50?	3·6?
September	...	...	...	...	4	1	1	...	1	...		Very doubtful.	...	1	...	...	8?	0·6?
October	...	...	...	3	...	...	...	...	...	...			...	...	1	...	4?	0·3?
November	...	...	...	...	...	1	...	...	...	...			...	...	...	...	1?	0·1?
December	...	...	...	...	...	...	...	...	...	...			...	...	...	...	0?	0?
Total	12	32	30	13	36	37	59	28	28	26	22?	17?	19	29	20	26	434?	31·1?

The air movement in 24 hours exceeds 200 miles on 31 days in the year on the average of the sixteen years 1879-1894. It exceeds that amount on more than five days in three months, *viz.*, April (7·6 days), July (6·8 days) and June (5·1 days), that is, in the month most representative of the hot weather in Bengal and in the earliest months of the rains. Strong winds exceeding 200 miles in 24 hours were recorded on no occasion in December, January and February.

The following gives for comparison the average number of days per mensem in which the air movement exceeds 200 miles per diem at Chittagong and Calcutta :—

Month	Average number of days on which 200 miles of wind was registered in 1879—1894.		Absolute maximum amount recorded in one hour in month at
	Chittagong.	Calcutta.	Chittagong.
January	0	0	14
February	0	0·2	18
March	2·7	2·4	26
April	7·6	9·9	25
May	4·3	10 8	24
June	5·1	4·6	25
July	6 8	3 4	23
August	3 6	2 0	25
September	0 6	1·2	19
October	0 3	0·2	32
November	0·1	0 1	35
December	0	0·1	17
Total	31·1	34 9	

The preceding data are interesting, as they show that strong winds (or an air movement exceeding 200 miles in 24 hours) are slightly more frequent at Calcutta than at Chittagong in the hot weather months of April and May, but are less frequent in July and August.

The following table gives data showing the mean number of days, in each month, on which winds of different strengths, or air movement of different amounts, obtained :—

Average number of days on which the air movement was	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total
Under 50 miles per day	17	12	6	1	1	1	1	4	8	19	21	22	113
Between 50 and 100 miles per day.	13	14	11	7	10	5	4	6	12	8	9	10	108
Between 100 and 150 miles per day	1	2	8	7	10	11	11	10	7	1	...	...	68
Between 150 and 200 miles per day.	...	...	4	7	6	9	10	8	3	1	...	...	48
Between 200 and 250 miles per day.	...	...	2	5	2	3	4	3	...	...	...	...	19
Between 250 and 300 miles per day.	...	...	1	2	1	2	1	..	...	...	...	...	7
Between 300 and 350 miles per day.	...	...	...	1	1	...	...	...	...	...	...	...	2
Over 350 miles per day .	...	...	...	...	...	...	...	...	...	...	...	...	0

The preceding data indicate that winds totalling less than 50 miles per diem prevail *on an average of 113 days in the year (or form 32 per cent. of the observations)* and totalling less than 100 miles on an average of 221 days (or 62 per cent.). Winds ranging between 100 miles and 200 miles occur in 116 days of the year, and exceeding 200 miles on only 28 days.

The following table gives the largest amount of wind recorded in an hour in each month of each year of the period 1880 to 1896:—

Year.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1880	11	15	21	20	17	25	15	15	14	10	12	12
1881	11	12	17	20	19	20	16	18	17	11	13	10
1882	11	?	?	?	?	?	20	21	15	19	8	10
1883	12	11	19	23	23	21	19	14	19	18	10	17
1884	10	16	19	20	20	19	20	18	17	16	35	9
1885	10	16	19	19	16	23	20	20	19	10	10	8
1886	8	?	16	19	17	20	18	20	15	12	9	8
1887	10	10	19	16	18	19	23	25	17	14	15	7
1888	12	12	20	25	17	15	22	20	12	8	6	8
1889	14	12	16	24	20	20	17	11	12	16	8	4
1890	...	10	18	20	20	20	18	17	11	7	3	5
1891	8	11	21	19	16	19	18	25	14	10	18	7
1892	9	18	26	19	20	18	19	15	15	12	7	6
1893	7	15	15	18	24	16	16	18	16	30	8	9
1894	8	12	20	20	23	29	20	15	15	15	8	7
1895	7	9	16	23	20	20	19	17	12	32	10	10
1896	9	17	13	18	15	16	14	14	15	7	8	9
Mean	9·8	12·8	18·4	20·2	19·1	20·0	18·5	17·7	15·0	14·5	11·1	8·6

The following table gives a summary of the absolute maximum velocity or amount of wind in 24 hours recorded in each month during the period, of the mean maximum amount in 24 hours, and mean daily amount for each month of the year:—

Month.	Hourly Movement.		
	Absolute maximum.	Mean maximum.	Normal mean.
January	14	9·8	2·0
February	18	12·8	2·5
March	26	18·4	4·5
April	25	20·2	6·4
May	24	19·1	5·6
June	29	20·0	6·3
July	23	18·5	6·5
August	25	17·7	5·4
September	19	15·0	3·5
October	32	14·5	2·0
November	35	11·1	1·7
December	17	8·6	1·7

The data of the preceding table indicate that the annual variation of the mean maximum wind velocity is similar to that of the mean air movement. The ratios of the strongest to the normal winds are greatest for the cold weather months, when the mean air movement is lowest. The strongest winds during the whole period were experienced during cyclonic storms or cyclones in the months of October and November. Winds during the cyclonic storms of the rains at Chittagong are no stronger than are frequently experienced in the hot weather months of March to May.

Abnormal or meteorological winds.

Cold weather period.—It has been already pointed out that Chittagong is not in the main stream of either of the two great currents which prevail in Bengal but is from its position in what may be termed a backwater.

This feature is only slightly exhibited in the months of December, January and February, when the north-westerly winds of the dry season hold with great steadiness at Chittagong as elsewhere in Bengal. The feeble depressions which advance eastwards across Northern India and give brief periods of moderate to strong southerly winds at Saugor Island, affect the amount of the air movement to a less degree at Chittagong but usually cause the wind to shift round to southerly directions for short periods. The greatest amounts of wind in one hour recorded by the anemograph during these months in the period 1880 to 1896 at Chittagong were 14 miles in January and 17 miles in February. These strong winds were registered during the passage of low pressure waves or depressions from North-West India across Bengal into Burma.

The winds are usually a little later in shifting permanently from their cold weather to their hot weather directions (south with slight westing) at Chittagong than at Saugor Island. This change occurs at Chittagong on the average in the first week of March. The following gives approximate dates of the change during the period 1880 to 1896:—

Year	Date of change
1880	March 12th.
1881	February 22nd.
1882	Instrument not working.
1883	March 12th.
1884	February 25th.
1885	March, 11th.
1886	February, 24th.
1887	February, 26th.
1888	March, 7th.
1889	March, 14th.
1890	March, 9th.
1891	March, 10th.
1892	February, 20th.
1893	March, 15th.
1894	March, 1st.
1895	March, 1st.
1896	February, 26th.

On the average of these years the date of commencement of the southerly winds of the hot weather period is the 4th of March.

Hot weather period.—The southerly winds which blow during the hot weather season are of very varying intensity, depending upon the temperature and pressure conditions in the interior, more especially in west Bengal, Bihar, and Chota Nagpur. The air movement at Chittagong during the hot weather period follows closely in its variation from day to day that of Saugor Island. The hot weather winds are occasionally of great intensity at the Bengal coast stations, where southerly winds of the force of a gale prevail. During the summer periods very strong easterly winds blow down the Assam valley, and vigorous hot day westerly winds down the Gangetic plain. The conditions for the greatest development of these winds are stated in the memoir on the winds of Saugor Island.

The following table gives three examples of vigorous air movement at Chittagong during the hot weather seasons of the period 1880 to 1896, one for each month of the period, and at intervals of four years. They are fairly typical of the strong sea winds of occasional occurrence in south Bengal during the hot weather. The periods selected are:—

May 28th to 30th, 1884.
April 14th to 17th, 1888.
March 28th to 30th, 1892.

The table gives the total amount of the air movement per diem, the percentage variation from the normal and the maximum amount of wind in one hour on each day during these three periods of strong hot weather winds at Chittagong and Saugor Islands.

	Chittagong.			Saugor Island.		
	Total amount during day.	Percentage variation from normal of month.	Greatest amount in one hour.	Total amount during day.	Percentage variation from normal o month.	G eatest amount in one hour.
(1st) March 28th to 30th, 1892						
„ 28th „	395	+269	26	709	+103	37
„ 29th „	389	+263	23	627	+ 80	35
„ 30th „	335	+213	20	617	+ 77	30
(2nd) April 14th to 17th, 1888						
„ 14th „	240	+ 56	15	695	+ 46	35
„ 15th „	293	+ 90	18	621	+ 31	38
„ 16th „	320	+108	20	575	+ 21	37
„ 17th „	326	+112	25	760	+ 60	37
(3rd) May 28th to 30th, 1884						
„ 28th „	238	+ 76	18	733	+ 60	33
„ 29th „	326	+141	20	754	+ 65	40
„ 30th „	334	+147	20	744	+ 62	40

The data of these periods of strong winds for south Bengal are of considerable interest. They indicate that at such periods the winds at Saugor Island blow a steady

gale with very slight irregular changes, and that there is practically no regular diurnal variation. At Chittagong, on the other hand, the air movement exhibits a fairly well marked diurnal variation, similar in character and epochs to that of ordinary weather, but of less amplitude relative to the mean of the day.

The following table giving the mean hourly movement for each of these three selected periods of strong hot weather winds at Chittagong and Saugor Island, shows this contrast clearly:—

Hour.	Mean hourly air movement for the 3 days March 28th to 30th, 1892 at		Mean hourly air movement for the 4 days April 14th to 17th, 1888 at		Mean hourly air movement for the 3 days May 29th to 30th, 1884 at	
	Saugor Island.	Chittagong	Saugor Island	Chittagong	Saugor Island	Chittagong
Midnight to 1 hour	29	14	29	10	31	12
1 hour „ 2 hours	29	16	27	8	34	8
2 hours „ 3 „	27	16	30	8	30	10
3 „ „ 4 „	26	15	28	7	32	7
4 „ „ 5 „	23	12	26	6	31	6
5 „ „ 6 „	24	9	26	8	30	9
6 „ „ 7 „	24	13	28	10	30	12
7 „ „ 8 „	24	15	26	12	33	12
8 „ „ 9 „	24	14	25	15	29	14
9 „ „ 10 „	25	18	28	16	30	11
10 „ „ 11 „	26	20	30	18	30	16
11 „ „ noon	24	19	27	17	30	14
Noon „ 13 hours	25	21	27	19	29	17
13 hours „ 14 „	27	19	25	17	31	14
14 „ „ 15 „	27	19	27	19	31	17
15 „ „ 16 „	28	15	27	17	31	15
16 „ „ 17 „	28	16	27	15	30	15
17 „ „ 18 „	28	14	26	13	29	16
18 „ „ 19 „	30	14	29	11	32	12
19 „ „ 20 „	32	13	28	13	30	12
20 „ „ 21 „	30	15	29	13	34	12
21 „ „ 22 „	30	14	31	12	32	12
22 „ „ 23 „	30	17	28	12	34	13
23 „ „ midnight	30	16	32	10	31	11

The data not only indicate the general character of these winds, but also show that although the movement is less vigorous at Chittagong than at Saugor Island, the increase of the movement relatively to the normal is greater and more marked at the eastern coast station. Winds are, at Chittagong, frequently from two to four times their

normal strength in these months, when the general movement is of considerable intensity.

It is noteworthy that the air movement at Saugor Island is of great intensity throughout the whole 24 hours during such periods and exhibits no marked diurnal variation such as invariably obtains over the whole of the interior of northern India in the hot weather. The air movement at Chittagong, on the other hand, exhibits a fairly well marked diurnal variation, agreeing closely with that which obtains on the average of the period.

This contrast between the air movement at Saugor Island and Chittagong is of considerable interest. Wind data are given in the memoirs on the winds of Calcutta and Saugor Island for three periods of very strong hot weather winds. The following gives data for Chittagong of these three periods for comparison with the corresponding data given in the Saugor Island and Calcutta memoirs :—

Hour	Hourly air movement at Chittagong for					
	Period, April 22nd to 25th, 1892.	April 25th 1892	Period, May 6th to 9th, 1883.	May 9th, 1883	Period May 23rd to 25th, 1894	May 23rd, 1894
Midnight to 1 hour.	9	9	6	3	10	14
1 hour „ 2 hours.	9	8	7	7	8	11
2 hours „ 3 „	9	9	7	10	7	5
3 „ „ 4 „	7	7	5	7	7	10
4 „ „ 5 „	7	7	6	7	7	10
5 „ „ 6 „	8	10	10	11	8	10
6 „ „ 7 „	9	14	10	9	7	11
7 „ „ 8 „	9	18	12	10	9	15
8 „ „ 9 „	9	13	11	12	11	14
9 „ „ 10 „	13	15	11	11	13	20
10 „ „ 11 „	14	18	17	19	15	13
11 „ „ noon	16	17	19	19	15	17
Noon „ 13 hours	17	16	16	13	13	18
13 hours „ 14 „	14	16	17	18	14	17
14 „ „ 15 „	15	18	17	20	13	19
15 „ „ 16 „	13	15	17	13	12	16
16 „ „ 17 „	15	17	14	15	12	13
17 „ „ 18 „	14	16	13	12	11	17
18 „ „ 19 „	11	14	14	15	11	10
19 „ „ 20 „	11	13	12	12	10	10
20 „ „ 21 „	9	10	11	9	9	10
21 „ „ 22 „	11	13	12	10	8	7
22 „ „ 23 „	12	10	13	7	9	9
23 „ „ Midnight	10	8	9	6	7	4

In the first, third and fifth figure columns are given mean hourly velocities for each of the three periods and in the second, fourth and sixth figure columns actual hourly amounts for the day in each period most representative of the period and characterised by the strongest winds. It will be noted that in each of these periods the diurnal variation of the velocity is very clearly exhibited.

The steadiness of the winds during these periods is shown by the following table which gives the number of winds (recorded at hourly intervals) from the sixteen points of the compass on each day during these three periods :—

Date and Year.	Total air movement in 24 hours ending mid-night of date.	Maximum air movement in an hour.	Number of hours wind blew from															
			N.	NNE.	NE.	ENE.	E.	ESE.	SE.	SSE.	S.	SSW.	SW.	WSW.	W.	WNW.	NW	NNW.
	Miles.																	
1892, April 22nd	260	18	...	...	...	...	...	...	...	12	12	.	...	...	...	...	...	.
„ „ 23rd	245	17	...	...	...	...	...	...	...	9	3	12	.	...	...	...		...
„ „ 24th	220	17	...	...	...	...	...	...	...	12	11	1	...	...	...	...	...	...
„ „ 25th	311	18	...	...	...	...	...	...	...	12	12	...	...	...	...	...	...	...
1893, May 6th	252	20	1	1	1	1	...	7	2	11	...	...	...	...	...	...	...	...
„ „ 7th	235	17	...	...	...	1	...	4	3	4	2	5	(No records for 5 hours.					
„ „ 8th	295	22	...	...	...	...	...	...	2	5	2	3	6	6	...	...	...	...
„ „ 9th	275	20	1	...	...	...	1	...	1	1	12	8	...	...	...	...	...	...
1894, May 23rd	170	10	..	...	...	...	2	2	4	13	2	1	...	...	...	...	...	...
„ „ 24th	183	17	...	...	...	...	...	...	3	20	1	...	...	...	...	...	...	...
„ „ 25th	275	23	...	...	...	...	...	...	...	18	3	3	...	...	...	...	...	.
„ „ 26th	305	28	...	...	...	...	...	...	...	13	6	5	...	...	...	...	...	...
„ „ 27th	300	20	..	...	...	...	..	—	3	14	4	2	...	...	...	...	1	...
„ „ 28th	216	21	...	...	...	1	5	5	...	8	3	...	..	1	...	...	1	...

South-west monsoon or rainy season.—The chief features of the weather or meteorology of the south-west monsoon or rainy reason in Bengal are fully given in the Saugor Island winds memoir. The rains usually set in about the middle of June. Cyclonic storms, sometimes of great intensity, form in the Bay before the advent of the monsoon proper. The storm data of the past 150 years show that these storms, which are usually initiated in May, advance either to the Lower Burma coast, the west Bengal coast or the Madras coast. There is no example of a storm having struck the Chittagong coast during this period. Chittagong is to some extent affected by the storms of this class which cross the west Bengal coast. Two examples of this type of storm gave strong winds to Chittagong during the period of the anemographic observations, *viz.*, the cyclone of May 25th to 27th 1887, and of May 25th to 27th 1893. These storms are briefly described in the Saugor Island memoir. It may be noted that the centre of the first storm crossed the coast near Balasore at 4 P.M. of the 26th and the second near Contai at 5 A.M. of the 26th.

The following gives complete wind data of Chittagong during these two storm periods :—

HOUR.	STORM OF 25TH TO 27TH MAY 1887.						STORM OF 25TH TO 27TH MAY 1893.					
	MAY 25TH, 1887.		MAY 26TH, 1887.		MAY 27TH, 1887.		MAY 25TH, 1893.		MAY 26TH, 1893.		MAY 27TH, 1893.	
	Wind direction.	Amount during hour.	Wind direction.	Amount during hour.	Wind direction.	Amount during hour.	Wind direction.	Amount during hour.	Wind direction	Amount during hour.	Wind direction.	Amount during hour.
Midnight to 1 hour	E	7	ESE	12	SE	7	SE	7	ESE	6	SE	11
1 hour to 2 hours	E	4	ESE	10	SE	7	SE	5	ESE	8	SE	11
2 hrs. „ 3 „	E	6	ESE	11	ESE	7	SE	6	ESE	7	SE	8
3 „ „ 4 „	E	8	ESE	13	ESE	7	SE	3	ESE	10	SE	12
4 „ „ 5 „	E	6	ESE	11	ESE	6	SE	2	E	10	SE	12
5 „ „ 6 „	E	4	ESE	9	SE	8	SE	8	ESE	10	SE	13
6 „ „ 7 „	E	7	ESE	10	SE	10	SE	7	E	10	SE	11
7 „ „ 8 „	ESE	11	ESE	15	SE	12	ESE	10	ESE	13	SE	13
8 „ „ 9 „	ESE	7	ESE	12	SE	13	ESE	9	ESE	8	SE	15
9 „ „ 10 „	ESE	12	SE	7	SSE	15	ESE	7	ESE	11	S	17
10 „ „ 11 „	ESE	18	SSW	3	SSE	12	ESE	8	ESE	13	S	21
11 „ „ Noon	ESE	14	WSW	14	S	13	E	6	SE	13	S	24
Noon to 13 hours	ESE	18	SSE	7	S	14	E	6	SE	16	SSW	19
13 hrs. „ 14 „	ESE	16	E	6	S	14	E	8	SE	14	SSW	19
14 „ „ 15 „	ESE	15	ESE	8	S	12	E	9	SE	9	S	16
15 „ „ 16 „	ESE	15	SE	15	SSE	15	E	12	SE	10	S	20
16 „ „ 17 „	ESE	13	SE	16	S	12	E	8	SE	8	S	19
17 „ „ 18 „	E	12	SE	11	S	11	E	11	SE	11	SSE	19
18 „ „ 19 „	ESE	10	SE	13	S	9	E	9	SE	9	SSE	19
19 „ „ 20 „	E	8	SE	8	S	7	E	9	SE	10	SSW	19
20 „ „ 21 „	ESE	6	SE	11	SSE	7	ESE	10	SE	10	S	19
21 „ „ 22 „	ESE	11	SE	10	SSE	9	SSE	10	SE	12	SSE	17
22 „ „ 23 „	ESE	12	SE	9	SSE	8	E	7	SE	13	SSE	17
23 „ „ midnight	ESE	11	ESE	8	SSE	5	E	10	SE	10	SSE	18

As Chittagong was at a considerable distance to the east of the tracks of the centres of these storms, there was comparatively little shift of wind at that station. The data show that during these storms, the diurnal variation was, on the whole, well marked and regular in character. In the storm of the 25th to 27th May 1887 the Chittagong data exhibit a large irregularity and diminution of wind force for some hours after the centre

passed inland near Saugor Island. This was exhibited to a similar extent at Saugor Island and Calcutta, and is hence probably a special feature of that storm and not due to local conditions at Chittagong.

The rains in Bengal are usually initiated in the second or third week of June by a cyclonic storm, generally of moderate intensity. These introductory storms pass inland across the Orissa or west Bengal coast, and hence affect the winds at Chittagong very slightly in direction, and only to a moderate extent in their intensity. Strong monsoon winds obtain for some time after the passage inland of each storm. During the remainder of the season from the middle of June to the end of September periods of strong monsoon winds alternate with periods of feeble winds at the head of the Bay. Each period of strong winds is, as a rule, initiated by a cyclonic storm, usually of slight to moderate intensity. These storms of the rains almost invariably form in the north-west of the Bay and cross the west Bengal or Orissa coast, and hence affect Chittagong very slightly. The chief feature of the air movement at Chittagong during the rainy season is thus the alternations of strength accompanying the general changes described above.

It will suffice to take three cases at random, *viz.*, the months of July 1884, August 1888 and September 1892.

The following table gives the periods in each of these months during which the air movement was alternately above and below the mean, the mean movement during each of these periods and the maximum or minimum amount of wind recorded in each period:—

Normal daily velocity in July 155 miles	Normal daily velocity in August 130 miles	Normal daily velocity in September 84 miles
July, 1884	August, 1888	September, 1892
1st to 11th above	1st to 4th below	1st to 5th above.
Maximum 234 on 2nd	Mimmum 71 on 3rd	Maximum 206 on 2nd.
Average 191 miles	Average 104 miles	Average 165 miles
12th to 19th below	5th to 16th above	6th to 7th below
Mmimum 85 on 15th	Maximum 234 on 13th	Minimum 36 on 7th.
Average 124 miles	Average 183 miles	Average 37 miles.
20th to 31st above	17th to 20th below	8th to 11th above.
Maximum 282 on 25th	Minimum 60 on 20th	Maximum 194 on 9th
Average 199 miles	Average 109 miles	Average 155 miles
	21st to 26th above	12th to 22nd below.
	Maximum 220 on 23rd	Minimum 19 on 16th.
	Average 177 miles	Average 40 miles.
	27th to 31st below	23rd to 30th above
	Mmimum 92 on 29th	Maximum 139 on 29th
	Average 108 miles	Average 96 miles.

The data show fully the variation or oscillatory character of the air movement in each of these months. The data for the month of September are very instructive from this point of view.

The retreating south-west monsoon period—October to December.—During the later stages of the south-west monsoon in October and November when the current is backing or retreating down the Bay the Chittagong coast is at distant intervals visited by severe cyclonic storms. They form in the centre of the Bay, and instead of passing westwards to the Madras coast proceed northwards. If these storms, as occasionally happens, recurve to the east, they strike the North Arakan and Chittagong coasts instead of the south Bengal or Orissa coast.

The only important storms of this class at Chittagong during the period were the following:—

(*a*) Storm of 1st November 1884.
(*b*) Storm of 22nd October 1893.
(*c*) Storm of 2nd October 1895.
(*d*) Storm of 12th December 1895.

There were no Bay-formed vigorous storms which affected Chittagong in the years 1879, 1880, 1881, 1882, 1883, 1886, 1887, 1889, 1891, 1892, 1894 and 1896, that is in twelve years out of the sixteen-year period.

It may also be noted that a feeble storm gave moderately strong winds to Chittagong on the 7th October 1888.

The following gives wind data for the more important of these storms, *viz.*, (*a*), (*b*) and (*c*):—

The storm of 1st November 1884.—There is no account of the storm given in the Annual Report on the Meteorology of India for the year. The following brief account is taken from the "Meteorological and Rainfall Summary for the month of November 1884" published by the Bengal Reporter.

"During the closing week of October a considerable burst of rainfall occurred over the greater part of Bengal; but on and after the 27th the north-east monsoon spread itself over the whole province, giving northerly winds with fine weather, a falling temperature, and clear skies. South-west monsoon winds were, however, probably still blowing in the centre of the Bay, and weather became unsettled in the Bay on the 31st instant, with the result that a small cyclonic whirl was generated near the head of the Bay. This storm must have been comparatively small and local, though rather severe in character, for it gave little or no indication of its existence till it reached the Chittagong coast on the 1st of November, crossing the mouth of the Megna into the Noakhally and Comilla districts. It had, however, filled up and almost disappeared before the 2nd, and thus the observations gave little indication of its character. Very strong winds, however, accompanied it and blew at Chittagong from about noon to 5 P.M. of the 1st, during which time they did a considerable amount of damage. Heavy rain accompanied this storm in the districts through which it passed."

The following wind data for Calcutta, Chittagong and Saugor island indicate the chief features of this storm :—

Hour.	1st November, 1884 Calcutta.		1st November, 1884, Chittagong		1st November, 1884, Saugor Island		Calcutta, November.		Chittagong, November		Saugor Island, November.	
	Wind direction	Amount during hour	Wind direction	Amount during hour.	Wind direction	Amount during hour.	Normal wind direction.	Normal amount during hour.	Normal wind direction	Normal amount during hour	Normal wind direction	Normal amount during hour.
Midnight to 1 hour	Calm	0	ENE	1	NNE	12	N 9° W	1·3	N 38° W	0·9	N 6° E	5·8
1 hour „ 2 hours	NNE	0·5	NE	1	NNE	14	N 7° W	1·3	N 31° W	0·9	N 6° E	6·0
2 hours „ 3 „	NNE	0·5	NE	2	NNE	12	N 7° W	1·4	N 27° W	0·9	N 5°	6·4
3 „ „ 4 „	NNE	0·5	Calm	0	NNE	12	N 6° W	1·5	N 25° W	1·0	N 5° E	7·0
4 „ „ 5 „	NNE	0·5	Calm	0	NNE	13	N 6° W	1·5	N 22° W	1·0	N 4° E	7·1
5 „ „ 6 „	NNE	1	Calm	0	NNE	17	N 5° W	1·6	N 19° W	1·1	N 4° E	7·3
6 „ „ 7 „	NNE	3	ENE	3	N	20	N 4° W	1·6	N 15° W	1·1	N 6° E	7·4
7 „ „ 8 „	NNE	3	NNE	5	N	21	N 3° W	2·1	N 14° W	1·5	N 8° E	7·2
8 „ „ 9 „	NNE	7	NE	10	NNW	20	N	3·2	N 8° E	1·9	N 12° E	8·7
9 „ „ 10 „	NNE	9	NNE	7	N	20	N 4° E	4·2	N 20° E	2·2	N 9° E	10·0
10 „ „ 11 „	NNE	8	ENE	13	N	23	N 6° E	4·9	N 25° E	2·4	N 1° W	11·0
11 „ „ Noon	NNE	15	ENE	10	N	27	N 1° E	5·4	N 15° E	2·3	N 12° W	11·7
Noon „ 13 hours	NNE	16	E	10	N	20	N 8° W	5·6	N 5° W	2·6	N 20° W	11·9
13 hours to 14 „	NNE	14	E	11	N	20	N 12° W	5·3	N 37° W	3·1	N 20° W	11·7
14 „ „ 15 „	N	8	ESE	24	N	19	N 14° W	5·0	N 59° W	3·6	N 19° W	10·7
15 „ „ 16 „	N	4	SE	34	N	11	N 12° W	4·5	N 68° W	3·3	N 14° W	9·6
16 „ „ 17 „	N	2	SSE	35	N	10	N 11° W	3·0	N 63° W	2·0	N 12° W	6·9
17 „ „ 18 „	N	1	S	32	N	5	N 8° W	1·4	N 59° W	1·4	N 10° W	5·5
18 „ „ 19 „	Calm	0	S	27	N	5	N 8° W	1·1	N 61° W	1·6	N 8° W	5·5
19 „ „ 20 „	Calm	0	S	14	NNW	6	N 9° W	1·2	N 58° W	1·3	N 3° W	5·4
20 „ „ 21 „	Calm	0	S	4	NW	4	N 8° W	1·1	N 57° W	1·1	N 1° W	5·3
21 „ „ 22 „	Calm	0	S	9	NW	4	N 10° W	1·1	N 52° W	0·9	N 1° E	5·2
22 „ „ 23 „	Calm	0	S	2	NW	1	N 10° W	1·2	N 51° W	0·9	N 3° E	5·3
23 „ „ Midnight	Calm	0	S	3	NW	4	N 10° W	1·3	N 46° W	0·8	N 4° E	5·6

The data for Saugor Island and Calcutta are in general agreement with those of Chittagong, and indicate that a storm of considerable intensity, but of small extent, affected the north of the Bay on the 1st November. The storm appears to have passed in a north-east or east-north-east direction across the head of the Bay towards Chittagong or to have recurved largely near the head of the Bay as it influenced the winds at Saugor Island and Calcutta sometime before it affected Chittagong. The most remarkable feature of the storm was the very short period during which strong winds lasted at all these stations. The maximum amount of 35 miles in an hour was recorded by the anemograph at Chittagong between 4 P.M. and 5 P.M. This is the largest amount registered in one hour by that instrument during its employment from 1879 to 1896.

The storm of the 22nd October 1893—This is fully described in the India Monthly Weather Review for October 1893, and was remarkable for its very small extent or diameter, as well as for the rapidity with which it developed. It formed on the 19th

and 20th to the west of Diamond Island in an area of squally weather and heavy rain. It advanced at first northwards, and on the 20th began to recurve slightly to east. On the 21st the centre passed about sixty miles to the west of Chittagong and on the morning of the 22nd struck the coast very near to the mouth of the Megna, passing over Noakhali about 11 A.M., and near to Comilla about 1-30 P.M. The storm is stated to have lasted about 12 hours at Noakhali, where 75 per cent. of the houses were blown down. Hardly a house was left standing in the Fenny sub-division. The longest diameter of the storm area was probably not more than 250 miles. The following gives wind observations on the 21st and 22nd at Chittagong as recorded by the anemograph:—

Hour.	October 21st, 1893.		October 22nd, 1893.		Normal October.	
	Wind direction.	Amount during hour.	Wind direction.	Amount during hour.	Wind direction.	Amount during hour
Midnight to 1 hour	Calm	0	ENE	4	S 8° W	1·2
1 hour „ 2 hours	Calm	0	NE	7	N 62° E	1·2
2 hours „ 3 „	NE	1	NE	9	N 42° E	1·2
3 „ „ 4 „	Calm	0	NE	10	N 4° E	1·3
4 „ „ 5 „	Calm	0	NE	13	N 29° E	1·3
5 „ „ 6 „	NE	1	ENE	20	N 40° E	1·3
6 „ „ 7 „	SSE	5	ENE	20	N 25° E	1·6
7 „ „ 8 „	S	3	E	28	N 31° E	2·2
8 „ „ 9 „	Calm	0	ESE	23	N 47° E	2·6
9 „ „ 10 „	Calm	0	N	1	N 35° E	2·5
10 „ „ 11 „	Calm	0	SSE	24	N 45° E	2·8
11 „ „ noon	ESE	3	S	25	N 36° E	2·9
Noon „ 13 hours	ENE	1	SSW	30	N 1° E	3·2
13 hours „ 14 „	ENE	2	SSW	25	N 54° W	3·5
14 „ „ 15 „	ENE	3	SW	25	N 69° W	3·9
15 „ „ 16 „	ENE	3	SW	20	N 75° W	3·6
16 „ „ 17 „	ENE	2	W	21	N 80° W	2·5
17 „ „ 18 „	ENE	4	WSW	12	N 85° W	1·5
18 „ „ 19 „	ENE	4	W	7	N 81° W	1·4
19 „ „ 20 „	ENE	2	W	6	N 87° W	1·5
20 „ „ 21 „	ENE	5	W	4	S 80° W	1·4
21 „ „ 22 „	ENE	5	W	2	S 88° W	1·4
22 „ „ 23 „	ENE	2	WNW	1	S 63° W	1·2
23 „ „ midnight	ENE	5	Calm	0	N 64° W	1·1

Storm of 2nd October 1895.—The storm of October 1895 is fully described in the India Weather Review for that month. It formed in the north-west of the Bay

on the 27th and 28th, and developed to a storm of moderate intensity on the 30th when it was advancing northwards and recurving to east. It increased in severity on the 31st October, when it crossed the coast some distance to the east of Saugor Island about 8 P.M. The centre advanced in a east-north-easterly direction during the night and was near Dacca on the morning of the 2nd. The storm filled up rapidly during the next 24 hours. Chittagong was hence at a considerable distance throughout from the centre of the storm, but had very strong winds on the morning of the 2nd, when it was in the south-east quadrant of the storm area. The following gives complete data of the air movement at Chittagong during the storm :—

Hour.	CHITTAGONG.				SAUGOR ISLAND.	
	October 1st, 1895.		October 2nd, 1895.		October 1st, 1895.	
	Wind direction.	Amount during hour.	Wind direction.	Amount during hour.	Wind direction.	Average hourly velocity.
Midnight to 1 hour	SE	2	SE	13	...	...
1 hour „ 2 hours	SE	6	SE	14	...	...
2 hours „ 3 „	SSE	4	ESE	15	...	...
3 „ „ 4 „	SE	7	S	18	...	...
4 „ „ 5 „	SSE	5	SSE	18	...	...
5 „ „ 6 „	SE	5	ESE	18	...	...
6 „ „ 7 „	ESE	5	SSE	21	...	...
7 „ „ 8 „	SE	5	SSE	22	E	13
8 „ „ 9 „	SE	3	SSE	24	...	...
9 „ „ 10 „	N	3	S	32	ENE	17
10 „ „ 11 „	ENE	7	S	29	NE	14
11 „ „ noon	E	5	S	26	...	...
Noon „ 13 hours	SE	8	SSW	29	...	...
13 hours „ 14 „	SE	9	SSW	28	ENE	28
14 „ „ 15 „	SE	9	SW	23	...	...
15 „ „ 16 „	ESE	9	SW	22	NE	30
16 „ „ 17 „	SE	10	WSW	27	NNE	30
17 „ „ 18 „	SE	11	WSW	24	...	...
18 „ „ 19 „	SE	10	WSW	16	...	...
19 „ „ 20 „	SSE	9	W	17	NW	44
20 „ „ 21 „	SE	8	W	10	...	...
21 „ „ 22 „	SE	11	W	11	...	...
22 „ „ 23 „	SE	11	W	12	WNW	39
23 „ midnight	SE	11	W	7	...	...

CONCLUDING REMARKS.

In the preceding discussion of the anemographic observations at Chittagong have been stated the more important features of the air movement at that station. These differ in several important respects from the air movement at Rangoon, more especially in the diurnal rotation of the winds.

The air movement at Chittagong is similar in its general character to that of south Bengal as given by the anemographic observations recorded at Saugor Island and Calcutta, but its direction is modified by its proximity to the Arakan hills. The mean air movement during the cold weather is from north-west as over south Bengal generally. The direction is more northerly than in central Bengal as shown by the following data for the month of December.

	Mean wind direction. December.
Calcutta	N. 13° W.
Burdwan	N 18° W.
Berhampore	N. 30° W.
Jessore	N. 13° W.
Narayanganj	N. 36° W.
Chittagong	N. 18° W.
Akyab	N. 6° W.
Diamond Island	N. 54° E.

The land current of the period recurves slowly under the action of the Arakan hills over the north-east of the Bay, and becomes part of the general drift from north east over the centre of the Bay. Southerly winds commence on the south Bengal coast in the latter part of February or the beginning of March and increase in strength with the increasing intensity of the thermal conditions of the interior. The chief feature in the pressure condition is the presence of a low pressure area on the mean of March and April in Chota Nagpur and south Bihar, and the development of a low pressure area in Sind which frequently forms the dominant feature during the greater part of May and gives a strong easterly tendency to the air movement in north-eastern India during short periods of three to six days. The mean wind direction at Chittagong determined by the indraught across the east coast of the Sunderbunds is almost parallel to the lie of the Arakan hills and at right angles to the general trend of the Bengal coast or coast of the Sunderbunds. It shifts slightly to east with the advance of the season from S. 10° W. to S. 5° E.

During the southwest monsoon or rainy season and while the main body of the Bay monsoon current is determined to the Gangetic Plain and the Punjab, the easterly deflection of the winds is more pronounced in the north-east angle of the Bay than in the preceding season. Winds are from about south south-east in June and July, but as the monsoon begins to weaken and when it withdraws from upper India the easterly deflection becomes less and less pronounced with the result that in September the mean direction of the air movement (S. 10° E.) is almost identical with that of May (S. 4° E.).

The mean direction of the air movement at Chittagong is hence throughout determined by the general conditions in northern India and the Bay but is considerably modified by the presence of the neighbouring hill ranges of the Arakan Yoma, the effect of which is large in the rainy season but slightly marked in the cold weather and hot weather seasons. The movement at any hour of the day may be analysed into the super-imposition of two alternating or oscillatory movements on the mean movement of the period determined by the general or mean conditions.

One of these two alternating movements is parallel to the lie of the Arakan hills and at right angles to the Bengal coast, and the other is east-west, transverse or at right angles to the Arakan and Chittagong hill ranges.

These may be considered separately. A reference to Plate XXVII, Figs. 5, 6, 7 and 8, will show that the diurnal movement in the east-west direction is similar in character throughout the whole year and is hence independent of the mean direction of the winds and of seasonal variation of meteorological condition.

This component movement is from east during the evening, night and morning hours and has its maximum amount at 8 A.M. in the hot weather and at 10 A.M. or 11 A.M. during the remainder of the year. This epoch hence varies slightly with the season.

The westerly component obtains from about noon to 8 P.M. and is greatest shortly after the period of maximum temperature and when the westerly movement down the Gangetic plain and across Central India is greatest in its diurnal variation. The amplitude of the complete east-west alternating movement varies largely with the season. It does not vary much during the rains or cold weather but increases up to a maximum in April when the amplitude is about twice as great as in July or December.

The northerly component is of small amplitude in the cold weather. The variation or alternating movement is, on the other hand, large in the hot weather and rains. The amplitude is almost the same in amount in the months of April and July representative of these seasons. The northerly movement is greatest about sunrise in both seasons and the southerly about the hottest time of the day. The month on the whole most representative of the cold weather conditions is January. Curves representing the diurnal variation of the velocity of the air movement, of the components of the diurnal variation in the north and east directions and of the diurnal rotation for that month will be found in Fig. 1, Plate XXV, Figs. 4 and 8, Plate XXVII and Fig. 1, Plate XIX. A reference to these curves will show at a glance that the following are the more important features of the diurnal variation of the air movement at Chittagong in that season:—

(1) The air movement is least about midnight, increases slightly until about 8 A.M., thence rather rapidly until about 1 P.M. and rapidly to 3 P.M., the maximum movement being recorded during the hourly interval from 2 to 3 P.M. The velocity decreases very rapidly from 3 or 4 P.M. to 5 or 6 P.M. and thence slowly from 6 P.M. to midnight with a sudden change of rate at 6 P.M.

(2) The northerly component is small in amount through the whole period, the only important feature being a slight increase in the positive direction from about 8 A.M. to 1 P.M., greatest at 10 A.M.

(3) The variation of the east component is large. It is positive during the night hours from 9 P.M., increasing very slightly in amount until

8 A.M. and thence largely until 11 A.M. when it diminishes rapidly It is negative in direction from 1 P.M. to 9 P.M. and is greatest from the negative westerly direction at 4 P.M.

As the mean wind direction is from N. 5°W. and the diurnal variation is almost solely in the east-west direction, the curve representing the diurnal rotation is an elongated and irregular shaped curve with its axis in the east-west direction and hence largely inclined to the mean direction of the air movement.

The following table gives data showing the variation of the pressure differences between Chittagong and seven stations near it in different directions and the variation of these differences from the mean of the day :—

	Actual difference of pressure reduced to sea-level and Lat. 45° in January.				Residual pressure difference in January.		
	Mean daily.	8 A. M.	10 A. M.	4 P. M.	8 A. M.	10 A. M.	4 P. M.
	"	"	"	"	"	"	"
Chittagong—Akyab . . .	+·027	+·018	+·021	+·021	—·009	—·006	—·006
Do. Narayanganj (Dacca)	+·006	—·002	+·005	+·012	—·008	—·001	+·006
Do. Silchar . . .	—·016	—·027	—·017	+·002	—·011	—·001	+·018
Do. Dhubri . . .	—·014	—·026	—·032	—·001	—·012	—·018	+·013
Do. Berhamporo . .	—·002	—·021	—·014	+·001	—·019	—·012	+·003
Do. Calcutta . . .	—·006	—·017	—·016	—·003	—·011	—·010	+·003
Do. Jessore . . .	0	—·010	—·013	—·006	—·010	—·013	—·006

The data indicate that the chief changes of pressure modifying the gradients occur over the interior of Bengal.

There is an increase in the gradients, more especially from east to west, between 8 and 10 A.M. which corresponds to the first period of rapid increase during the morning. This is followed by a considerable temporary decrease of rate from about 10 A.M. to noon, following the period of most rapid increase of temperature during the day. The probable cause of this is probably a temporary increase of pressure during the period of most rapid day rise of temperature in Bengal. A similar effect in the air movement at Rangoon has been thus explained in the memoir on the winds of Rangoon and it is hence sufficient to state here that the peculiar features of the movement at Chittagong appear to confirm the conclusions there stated.

Pressure decreases generally in the interior of Bengal with respect to Chittagong during the period from 10 A.M. to 4 P.M. and probably the adjacent sea area and at 4 P.M. the gradients are very small between Chittagong and the neighbouring stations. The velocity, however, increases due to large increase of movement from the west so that at the epoch of greatest movement the mean wind direction is almost due west. From 4 P.M. to 6 P.M. the velocity decreases with great rapidity—this period coincides with the period

of greatest decrease of temperature in the 24 hourly variation. Here again the tendency of the pressure changes due to cooling is delayed for a period due probably to actions explained in the Rangoon memoir. The residual air movements do not appear to be directly related to the pressure residuals in Bengal given in the fifth, sixth and seventh figure columns. The increasing velocity and westing of the movement is chiefly an effect of the general increase in central India.

This appears to be confirmed by the data of the following table giving the mean wind direction and steadiness at ten stations in Bengal:—

	Mean wind direction in January.			Mean steadiness of wind January.		
	8 A.M.	10 A.M.	4 P.M.	8 A.M.	10 A.M.	4 P.M.
Chittagong	N 28° E	N 40° E	N 76° W	55	62	68
Narayinganj (Dacca)	N 10° W	N 22° W	N 75° W	39	38	27
Jessore	N 14° W	N 43° W	N 34° W	14	58	49
Saugor Island	N 13° E	N 23° E	N 73° W	64	40	22
Calcutta	N 6° W	N 10° W	N 41° W	32	42	62
Burdwan	N 23° W	N 18° W	N 49° W	26	65	34
Berhampore	N 67° W	N 33° W	N 56° W	26	49	55
Dhubri	N 55° E	N 72° E	E	39	40	8
Akyab	N 21° E	N 42° E	N 70° W	87	67	71
Diamond Island	N 14° E	N 14° E	N 14° W	81	81	65

The wind direction data show that with the exception of Dhubri which really represents the Assam valley and not any part of Bengal, the air movement at 10 A.M., varies somewhat irregularly from that at 8 A.M. The data for all stations show that there is between 10 A.M. and 4 P.M. a marked increase in the strength of the westerly element, which is as large an amount at Saugor Island and Calcutta as at Chittagong. It cannot be due solely to a local hill and plain or to a land and sea effect at Chittagong and is hence in part at least a result of the general large increase of movement in the Gangetic plain due to the day thermal actions. This westerly influence is shown almost as strongly at Akyab as at Chittagong. This, on the other hand, indicates movement between land and sea and that the day movement from west at these two stations may be in part a sea breeze and hence that at Chittagong the day shift of wind accompanying the alternation of land and sea breezes may be supplemented by the general increase during the day of the westerly movement in the Gangetic plain and Bengal. April is the month most fully representative of the hot weather air movement at Chittagong. A comparison of the curves, Fig. 4, Plate XXV, Figs. 1 and 5, Plate XXVII, and Plate XX, shows at a glance the more important features.

The air movement is greatest in April, and the amplitude of the diurnal variation of the velocity is also greatest.

The movement is least about sunrise from 4 to 5 A.M. It increases from that hour more or less regularly to the maximum of the day at 3 P.M. (2 P.M. in May). It decreases slightly until 4 P.M. and thence very rapidly until 8 P.M. when the rate of change is abruptly and largely diminished. It continues to diminish slowly during the night hours. The velocity curve bears a considerable resemblance to the curve giving the diurnal variation of temperature. The minimum epochs are identical but the maximum epoch of the movement is about an hour later than the corresponding temperature epoch. The most conspicuous and interesting minor features of the velocity curves of the period are a marked large diminution of the rate of increase during the morning hours from 8 to 10 A.M. and the very rapid decrease of velocity from 4 P.M. to 7 P.M. These features are exhibited in the curves of the cold weather and rainy season, but are most pronounced in the hot weather when the temperature changes are large and rapid. The diurnal rotation of the air movement as exhibited by the method of resolution employed is due to alternating movements in the north-south and east-west direction of nearly equal amplitude. The axes of the curves representing the diurnal rotation of the hot weather are hence oval curves with their axes in a south-west to north-east direction and hence making a large angle with the mean wind direction (approximately south).

The following data give the pressure differences at 8 hours, 10 hours, and 16 hours, between Chittagong and seven stations in different directions:—

	Actual difference of pressure reduced to sea level and Lat 45° in April.				Residual pressure difference in April.		
	Mean daily	8 Hrs.	10 Hrs.	16 Hrs.	8 Hrs.	10 Hrs.	16 Hrs.
	"	"	"	"	"	"	"
Chittagong—Akyab	—·014	—·014	+·009	—·008	0	+·023	+·006
Do. Narayanganj (Dacca)	+·044	+·042	+·073	+·072	—·002	+·029	+·028
Do Silchar	—·003	—·007	+·017	+·023	—·004	+·020	+·026
Do Dhubri	+·044	+·035	+·056	+·074	—·009	+·012	+·030
Do Calcutta	+·061	+·058	+·082	+·077	—·003	+·021	+·016
Do. Berhampore	+·087	+·071	+·097	+·113	—·016	+·010	+·026
Do. Jessore	+·065	+·052	+·069	+·075	—·013	+·004	+·010

The preceding data indicate that the pressure differences are large between Chittagong and the interior of Bengal and that they increase from 8 A.M. to 4 P.M., most largely from 8 A.M. to 10 A.M. The change of gradients between Chittagong and neighbouring stations indicates a large increase of movement from south and east in south Bengal.

The following shows the changes of the mean wind direction at these stations accompanying the pressure changes :—

	Mean Wind direction in April.		
	8 A.M.	10 A.M.	4 P.M.
Chittagong	S 47° E	N 70° E	S 44° W
Narayangang (Dacca) . . .	S 10° E	S 1° W	S 3° E
Jessore	S 1° E	S 30° W	S 67° W
Saugor Island	S 18° W	S 37° W	S 8° E
Calcutta	S 25° W	S 35° W	S 24° W
Burdwan	S 27° W	S 34° W	S 53° W
Berhampore	S 2° E	S 2° W	S 62° W
Dhubri	N 72° E	N 72° E	N 81° E
Akyab	N 48° E	S 51° W	S 76° W
Diamond Island . . .	N 47° W	N 53° W	N 63° W

The preceding data establish that the diurnal changes of the air movement in Bengal in this season are much less uniform than in January. At the majority of the stations winds blow much more directly from the west in the afternoon than the morning hours. It is hence evident that the increased day movement in the Gangetic plain modifies the air movement considerably in central and perhaps in south-east Bengal.

The wind data for Akyab and Diamond Island show that a similar increase of movement from the west occurs at these stations, and at Akyab the wind as at Chittagong shifts from an easterly direction of 8 A.M. to westerly during the afternoon hours. The alternating movement in the east-west directions is too large in April to be explained as a sea breeze only. It hence appears probable that the east-west alternating movement in April is in part due to excess of westerly movement in the afternoon hours caused by the intensification and extension of westerly movement across Bengal and in part to the usual action between hills and plains and sea areas.

The diurnal variation of the air movement is similar in character throughout the whole period from March to September. The curves for July in Plates XXII, XXVI and XXVII give the more important features of the diurnal variations for the month most fully representative of the south-west monsoon period. The amplitude of the actual air movement, and of the east component decreases slightly throughout the period. That of the north component is as large in July as in April.

The following table shows the diurnal changes of the pressure difference between Chittagong and neighbouring stations in July:—

	Actual difference of pressure reduced to sea-level and Lat. 45° in July.				Residual pressure difference in July.		
	Mean daily.	8 Hrs.	10 Hrs.	16 Hrs.	8 Hrs.	10 Hrs.	16 Hrs.
	"	"	"	"	"		"
Chittagong—Akyab . . .	—·041	—·039	—·044	—·045	+·032	—·003	—.004
Do. Narayanganj (Dacca)	+·045	+·041	+·057	+·065	—·004	+·012	+·020
Do. Silchar . . .	+·009	—·010	+·012	+·032	—·019	+·003	+·023
Do. Dhubri . . .	+·046	+·035	+·035	+·057	—·011	—·011	+·011
Do. Berhampore . .	+·084	+·069	+·081	+·093	—·015	—·003	+·014
Do. Calcutta . . .	+·078	+·077	+·085	+·088	—·001	+·007	+·010
Do. Jessore . . .	+·071	+·061	+·064	+·075	—·010	—·007	+·004

The preceding data show that pressure is in much larger defect in the interior of Bengal relatively to Chittagong at 4 P.M. than at 8 A.M. The differences also in most cases increase as largely from 8 to 10 A.M. as from 10 A.M. to 4 P.M. Actual gradients and the residuals both suggest that the easterly component of the air movement should increase during the day hours. This is certainly not the case at Chittagong as there is in the afternoon hours a considerable westerly component which has its maximum intensity about 4 P.M.

The pressure differences and residuals indicate that the depression in Bengal relatively to the coast increases and extends eastwards and northwards, as is seen by comparing the Silchar and Dhubri data with Jessore and Calcutta.

The data in the table below indicate the change that occurs during the day in the direction of the movement over Bengal:—

	Mean wind direction in July.		
	8 A.M.	10 A.M.	4 P.M.
Chittagong	S 36° E	S 73° E	S 8° W
Narayanganj (Dacca) . . .	S 27° E	S 17° E	S 9° E
Jessore	S 21° E	S 18° E	S 17° E
Saugor Island	S 27° W	S 36° W	S 3° W
Calcutta	S 5° W	S 5° W	S 2° E
Burdwan	S 3° E	S 14° E	S 22° E
Berhampore	S 25° E	S 37° E	S 42° E
Dhubri	S 83° E	N 81° E	S 17° E
Akyab	S 38° E	S 22° E	S 14° W
Diamond Island	S 43° W	S 40° W	S 43° W

The data for the majority of stations, especially those in west and central Bengal, indicate that there is a considerable to large increase in the easterly element of the air movement between 8 A.M. and 4 P.M. It is in fact shown by all stations except Jessore and Dacca where there is a slight decrease and except Chittagong. A comparison with the data of Akyab shows that at that station as also slightly at Diamond Island the wind changes from south-easterly to south-westerly direction during the afternoon. The westing of the wind at Chittagong and Akyab is hence very probably due to alternative actions between the hills and plains and perhaps to the occurrence of rainfall and release of energy on the adjacent hills in considerably large amounts during the day than the night hours.

The curves indicating the diurnal variation of velocity in this period follow closely the variation of temperature in Bengal and the temperature differences between the coast and interior. The movement is least at 5 A.M. and increases fairly regularly to the maximum of the day from 2 P.M. to 3 P.M. It decreases rapidly from 4 P.M. to 8 P.M., the rate being greater than the morning rate of increase. The rate of decrease changes suddenly in amount at 7 or 8 P.M. and from that epoch until 5 A.M. the velocity diminishes slowly but fairly regularly.

A reference to the curves will show that the peculiar features exhibited strongly in the cold and hot weather seasons between 8 A.M. and 11 A.M. and from 4 P.M. to 6 P.M. are also present in the rains but are less prominent than in the cold weather and hot weather seasons.

The following table gives for reference the constants of the harmonic formulæ (second form) representing the variation of the north and east components of the diurnal variation of the air movement.

Month.	North component					East component				
	M.	U_1.	u_1	U_2	u_2	M	U_1.	u_1.	U_2.	u_2
			° ′		° ′			° ′		° ′
January	+0·68	0·49	316 10	0·17	131 17	−0·68	1·09	4 54	0·82	143 39
February	+0·07	0·41	349 15	0·28	173 33	−0·78	1·18	238 32	0·86	148 9
March	−3·17	1·39	49 7	0·68	215 8	−0·65	2·35	23 31	1·20	170 51
April	−1·08	2·67	57 40	0·85	227 51	−0·48	2·88	29 0	1·07	160 17
May	−3·30	3·08	55 23	0·80	224 27	+0·23	2·14	22 26	1·11	178 39
June	−4·37	2·24	47 7	0·62	209 13	+1·46	1·33	22 44	0·98	171 13
July	−4·86	2·34	35 39	0·62	203 14	+1·55	1·13	19 1	0·99	160 34
August	−4·11	2·96	40 12	0·67	199 29	+1·09	1·25	14 30	1·11	159 4
September	−2·10	1·32	45 57	0·60	198 33	+0·39	1·19	13 45	1·00	161 1
October	−0·03	0·26	321 8	0·18	161 9	0	0·75	11 25	0·61	155 34
November	+0·65	0·44	290 0	0·16	114 23	−0·42	0·65	357 58	0·54	149 38
December	+0·77	0·46	297 17	0·18	107 49	−0·56	0·78	359 38	0·67	141 27
Year	−1·90	1·16	54 37	0·43	233 8	+0·10	1·38	32 42	0·90	192 28

APPENDIX B.

TABLE 1.—*Mean movement of air irrespective of direction in each hourly interval of each month as registered by a Beckley's anemograph at Chittagong from June 1879 to December 1896*

Hour	January	February	March	April	May.	June.	July.	August.	September	October	November	December	Year
Midnight to 1	1·11	1·27	2·81	4·23	3·86	4·06	4·83	3·88	2·12	1·22	0·93	0·97	2·65
1 to 2	1·22	1·27	2·66	4·00	3·90	4·36	4·68	3·68	2·04	1·21	0·88	1·03	2·58
2 to 3	1·21	1·34	2·51	3·69	3·74	4·17	4·38	3·49	2·03	1·21	0·93	1·09	2·49
3 to 4	1·29	1·37	2·66	3·63	3·72	4·23	4·43	3·40	2·18	1·26	1·02	1·22	2·53
4 to 5	1·28	1·40	2·55	3·41	3·48	4·22	4·18	3·34	2·02	1·29	1·08	1·19	2·45
5 to 6	1·43	1·41	2·55	3·61	3·66	4·17	4·22	3·47	2·07	1·28	1·06	1·24	2·52
6 to 7	1·46	1·47	2·73	4·21	4·14	4·91	4·78	3·90	2·55	1·56	1·12	1·34	2·91
7 to 8	1·46	1·63	3·36	5·14	5·38	6·18	5·73	4·92	3·15	2·23	1·45	1·58	3·56
8 to 9	1·92	1·85	3·93	6·30	5·43	6·46	6·12	5·38	3·74	2·57	1·92	1·69	3·91
9 to 10	2·18	2·41	4·51	6·89	5·85	6·63	6·59	5·69	4·01	2·52	2·20	2·08	4·32
10 to 11	2·38	2·95	5·69	8·70	7·19	7·75	7·81	6·74	4·56	2·80	2·36	2·29	5·11
11 to noon	2·71	3·42	6·63	9·77	8·13	8·53	8·41	7·27	5·13	2·92	2·33	2·41	5·71
Noon to 13	3·12	4·13	7·44	10·62	8·88	8·98	8·93	7·92	5·59	3·21	2·55	2·72	6·17
13 to 14	4·01	5·26	8·14	10·73	9·28	9·64	9·33	8·35	6·23	3·50	3·10	3·26	6·71
14 to 15	4·64	5·51	8·41	10·82	9·16	9·53	9·36	8·51	6·47	3·91	3·63	3·29	6·93
15 to 16	4·59	5·75	8·16	10·45	9·09	9·21	9·35	8·27	6·12	3·63	3·29	3·21	6·81
16 to 17	3·29	4·63	7·08	9·45	8·21	8·45	8·78	7·59	5·32	2·52	1·99	2·13	5·79
17 to 18	1·78	2·77	5·29	7·82	6·78	7·69	8·11	6·69	3·88	1·53	1·41	1·49	4·60
18 to 19	1·61	2·15	4·08	6·16	5·21	6·37	6·98	5·60	2·91	1·44	1·55	1·43	3·80
19 to 20	1·51	2·05	3·41	5·13	4·31	5·53	6·26	4·96	2·60	1·53	1·29	1·32	3·33
20 to 21	1·22	1·69	3·24	4·86	4·07	5·34	5·87	4·81	2·57	1·42	1·13	1·03	3·10
21 to 22	1·05	1·56	2·91	4·68	3·91	5·01	5·69	4·56	2·45	1·37	0·92	0·98	2·92
22 to 23	0·96	1·41	2·85	4·26	3·99	4·82	5·22	4·16	2·32	1·17	0·92	0·98	2·73
23 to midnight	0·99	1·27	3·01	4·49	3·89	4·58	5·23	3·98	2·19	1·14	0·83	0·83	2·71
Total daily	48·55	59·98	106·70	151·10	135·19	151·32	155·30	130·46	85·58	48·11	41·75	41·14	77·77
Mean hourly	2·02	2·50	4·15	6·43	5·64	6·31	6·47	5·44	3·57	2·02	1·76	1·71	4·82

RECORDED AT CHITTAGONG FROM JUNE 1879 TO DECEMBER 18[illegible]

TABLE. 2.—*Number of winds recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years.*

JANUARY.										FEBRUARY.									
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
0	71	13	5	8	12	19	65	106	183	0	41	10	6	31	31	21	74	75	146
1	88	17	5	9	12	19	64	102	165	1	52	8	9	33	27	15	65	66	162
2	108	23	7	10	13	13	56	79	172	2	58	13	12	37	22	13	58	62	162
3	127	27	12	7	7	10	57	76	159	3	68	16	16	38	23	15	50	61	152
4	128	31	13	10	6	13	55	84	142	4	78	24	18	35	22	15	36	53	138
5	145	38	13	9	7	11	53	73	134	5	77	26	22	34	17	13	32	53	144
6	144	40	14	7	7	8	51	79	132	6	81	29	24	30	17	13	31	47	146
7	142	46	15	8	7	9	45	79	131	7	82	36	28	28	17	12	53	46	136
8	148	57	16	7	9	8	46	74	114	8	83	42	28	29	16	15	56	55	108
9	156	88	20	8	5	10	46	69	55	9	103	65	25	22	21	16	52	56	52
10	209	140	27	4	2	6	29	27	27	10	170	108	30	15	16	10	26	40	24
11	156	194	44	7	6	7	23	29	14	11	139	138	43	21	33	20	23	28	7
Noon	167	149	48	12	14	14	28	44	4	Noon	133	99	36	28	43	32	29	40	2
13	168	78	32	20	23	30	47	80	3	13	99	43	34	21	30	64	69	58	2
14	122	39	14	19	24	57	107	99	2	14	65	21	16	11	41	86	125	74	1
15	70	19	6	10	19	68	188	102	1	15	36	15	12	8	34	90	173	72	0
16	44	10	3	3	13	66	215	122	6	16	24	8	7	6	32	83	198	79	3
17	31	11	3	3	12	48	205	131	39	17	13	7	6	4	29	81	185	102	11
18	22	9	3	4	7	37	171	114	115	18	12	8	6	6	29	71	170	92	46
19	19	8	3	3	7	32	163	110	137	19	13	4	5	7	29	58	157	82	84
20	23	6	3	4	6	26	147	102	162	20	15	4	5	8	30	50	145	87	95
21	31	9	3	6	6	27	124	100	176	21	19	7	6	9	34	40	126	79	119
22	45	10	4	6	11	21	89	98	198	22	32	6	5	15	38	28	103	79	130
23	54	8	5	9	6	20	71	97	212	23	32	7	6	27	31	20	88	75	149
Total	2418	1081	318	193	241	579	2145	2076	2483	Total	1520	744	405	503	682	881	2184	1551	2019
Per cent.	21'0	9'4	2'8	1'7	2'1	5'0	18'6	18'0	21'5	Per cent.	14'5	7'1	3'9	4'8	6'5	8'4	20'8	14'9	19'2

TABLE 2.—*Number of winds recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years*—contd.

MARCH.										APRIL.									
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W	Calm.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
0	15	14	21	98	103	45	32	30	99	0	13	17	25	110	148	53	33	19	47
1	19	11	26	104	100	32	44	34	103	1	11	12	31	132	137	40	25	16	47
2	22	13	38	107	89	23	51	32	98	2	12	23	31	153	132	29	33	15	45
3	25	14	35	114	87	21	42	37	99	3	9	26	46	131	134	26	27	14	44
4	29	17	41	116	81	21	42	35	91	4	7	30	55	156	126	22	32	15	34
5	33	21	46	125	73	13	40	27	95	5	7	24	55	165	115	21	28	16	46
6	32	20	50	123	67	14	34	31	101	6	7	23	56	171	109	20	31	14	42
7	36	25	53	129	64	15	34	30	85	7	11	27	63	168	94	20	25	15	30
8	42	26	58	134	61	17	37	41	54	8	12	29	59	196	101	20	32	13	14
9	44	41	64	136	70	14	27	37	18	9	13	27	51	167	125	20	30	12	10
10	112	69	62	80	91	23	17	16	6	10	45	30	40	77	182	47	20	12	4
11	70	49	42	62	140	58	24	26	7	12	26	19	31	47	220	89	24	14	0
Noon	53	28	29	43	144	105	38	33	3	Noon	18	10	20	30	208	137	36	13	0
13	34	14	21	23	122	151	80	32	1	13	12	7	19	19	182	167	55	11	0
14	23	11	10	18	104	167	106	35	2	14	9	5	12	14	160	192	69	13	0
15	8	9	10	13	96	166	133	40	1	15	10	4	9	17	150	191	79	15	0
16	4	6	11	14	93	162	139	42	2	16	11	2	8	15	142	195	83	18	2
17	6	7	11	16	87	159	137	45	5	17	8	7	6	16	155	184	84	16	1
18	6	7	9	18	85	154	124	47	22	18	11	6	8	20	147	176	96	21	3
19	5	7	12	20	88	133	117	43	47	19	8	11	11	20	144	156	81	19	16
20	6	10	12	29	88	119	105	46	58	20	11	13	19	38	135	125	73	18	33
21	8	5	25	40	98	93	98	45	72	21	12	10	26	44	158	108	69	21	36
22	15	6	18	54	100	81	77	35	88	22	20	18	26	61	153	89	43	20	37
23	19	9	18	85	110	52	62	26	96	23	17	17	25	87	144	63	42	20	39
Total	668	439	712	1701	2241	1841	1660	845	1253	Total	329	299	750	2114	3523	2169	1153	580	513
Per cent.	59	39	63	150	197	162	146	74	110	Per cent.	28	26	66	186	310	193	101	53	47

TABLE 2.—*Number of winds recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years*—contd.

MAY.										JUNE.									
Hour	N.	N.E.	E.	S.E	S.	S.W.	W.	N.W.	Calm	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
0	13	17	52	115	133	62	42	9	45	0	2	10	44	203	156	25	12	4	12
1	8	19	58	130	128	56	39	12	35	1	3	11	44	200	135	23	10	2	21
2	10	18	68	138	124	50	32	11	36	2	2	12	54	200	149	19	14	3	15
3	10	20	79	149	116	42	29	11	30	3	3	12	61	207	138	12	8	5	22
4	8	18	88	163	110	34	28	10	24	4	4	18	70	203	131	16	7	2	18
5	6	26	96	157	99	36	22	8	36	5	4	12	77	202	124	18	6	4	21
6	8	24	102	162	97	31	21	7	35	6	2	16	88	195	116	24	10	3	13
7	7	29	115	169	89	28	23	6	19	7	2	16	84	209	113	19	9	4	8
8	8	34	111	185	83	26	27	6	5	8	1	15	84	201	125	19	10	2	2
9	4	30	106	166	100	19	18	6	6	9	1	8	65	192	103	17	10	2	2
10	47	40	87	124	128	26	19	9	5	10	25	24	60	186	129	19	8	2	4
11	27	27	49	101	181	60	23	11	2	11	14	12	45	168	169	45	10	2	1
Noon	13	16	35	68	195	113	30	12	1	Noon	9	12	37	127	168	77	10	6	0
13	5	11	29	43	183	154	50	4	1	13	7	10	28	101	191	110	14	4	1
14	4	9	27	39	154	173	69	5	1	14	3	8	15	82	196	136	17	5	3
15	6	10	24	32	140	175	89	6	1	15	1	7	16	80	181	143	33	4	2
16	5	11	15	41	132	173	98	6	4	16	3	7	16	79	188	132	34	6	2
17	3	9	17	47	131	171	95	9	4	17	2	10	20	87	190	120	34	3	2
18	6	6	26	48	135	161	80	11	10	18	2	8	20	108	191	106	28	2	4
19	8	11	29	30	140	136	70	12	26	19	1	7	23	133	189	80	25	4	8
20	6	13	27	72	140	120	57	9	38	20	3	9	31	163	175	53	20	4	9
21	6	12	36	85	141	106	54	10	33	21	2	11	35	173	173	46	13	3	10
22	12	20	40	98	134	75	47	8	44	22	1	9	49	178	172	28	14	3	14
23	9	18	46	116	132	77	38	10	39	23	2	8	43	198	162	24	13	3	15
Total	239	448	1362	2499	3145	2104	1100	208	480	Total	99	272	1109	3874	3804	1311	371	82	209
Per cent.	2·1	3·9	11·8	21·6	27·1	18·2	9·5	1·8	4·1	Per cent	0·9	2·4	10·0	34·8	34·2	11·8	3·3	0·7	1·9

TABLE 2.—*Number of winds recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years*—contd.

July.										August.									
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
0	3	4	32	257	193	20	4	...	24	0	1	2	29	216	215	21	9	1	5
1	2	4	36	260	181	22	5	1	23	1	1	2	33	220	206	20	5	..	55
2	...	4	41	258	178	23	7	2	23	2	2	2	35	232	193	17	6	...	51
3	2	5	55	253	158	22	8	2	29	3	2	3	47	225	181	20	9	2	54
4	2	10	62	244	158	22	11	2	25	4	2	5	58	229	168	22	8	2	47
5	3	10	70	251	140	19	11	2	28	5	3	10	59	229	162	22	6	1	50
6	2	10	76	247	144	19	8	1	27	6	2	10	68	227	150	22	5	1	53
7	2	13	80	252	134	24	9	1	20	7	2	11	81	230	150	22	9	1	54
8	1	8	83	270	128	24	9	2	8	8	2	11	88	242	145	21	9	1	20
9	2	7	70	241	121	26	6	1	9	9	1	11	70	242	129	19	3	2	11
10	25	28	98	227	116	24	6	2	7	10	32	42	94	231	112	13	2	1	7
11	10	19	45	236	190	37	5	...	5	11	15	17	50	236	180	25	5	2	11
Noon	7	7	30	186	228	66	12	...	3	Noon	9	13	34	176	241	55	6	1	6
13	2	5	21	141	243	114	10	2	3	13	9	7	16	124	254	111	12	1	6
14	2	4	14	100	265	136	16	2	2	14	2	3	8	89	246	157	23	5	6
15	...	4	8	87	267	146	23	4	1	15	3	1	5	71	241	174	29	2	4
16	1	1	8	98	259	143	23	3	4	16	2	1	3	66	237	181	35	5	9
17	1	1	7	108	263	137	20	1	2	17	..	2	5	76	240	168	35	4	12
18	...	1	9	129	263	117	15	1	7	18	...	2	8	100	246	131	35	2	17
19	...	...	12	165	249	89	15	1	9	19	...	1	8	140	244	94	28	4	25
20	...	...	17	199	238	60	12	1	12	20	1	2	15	167	233	69	17	1	37
21	1	...	23	218	228	48	9	1	11	21	2	3	16	198	222	42	16	2	40
22	5	2	25	240	210	31	8	1	16	22	3	7	32	152	166	33	10	1	29
23	5	1	29	248	209	20	6	1	18	23	1	2	29	208	218	27	5	1	52
Total	78	139	951	4917	4763	1389	238	34	318	Total	97	170	888	4324	4779	1456	340	43	703
Per cent.	0·6	1·1	7·4	38·3	37·1	10·8	2·0	0·3	2·5	Per cent.	0·8	1·3	6·9	33·7	37·2	11·6	2·7	0·3	5·5

TABLE 2.—*Number of winds recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years*—contd

	SEPTEMBER									OCTOBER								
Hour	N.	N.E	E.	S E	S	S W.	W	N W.	Calm	Hour	N	N E.	E	S E	S	S.W.	W.	N W.	Calm
0	8	16	46	138	131	48	23	11	110	0	47	21	37	48	37	25	41	42	232
1	5	15	47	148	131	48	19	7	112	1	50	20	39	54	43	26	40	47	214
2	6	17	56	148	126	43	22	10	106	2	47	23	39	57	38	25	40	49	215
3	5	16	63	156	109	48	22	7	105	3	58	26	42	55	37	20	36	46	213
4	8	17	68	159	106	41	22	8	104	4	60	22	46	60	35	21	47	57	184
5	6	19	74	155	101	37	23	9	109	5	67	28	54	50	35	22	39	49	188
6	7	19	81	154	104	38	23	9	98	6	62	34	53	51	29	21	37	43	202
7	8	25	96	160	102	47	30	10	56	7	77	37	62	51	32	22	42	56	152
8	14	33	109	169	100	35	24	10	38	8	115	70	76	59	28	21	43	56	63
9	17	32	93	175	97	26	22	8	27	9	92	121	83	57	26	18	29	43	33
10	75	76	96	146	79	20	14	9	15	10	165	165	67	37	19	11	17	18	30
11	46	47	78	155	134	37	15	12	7	11	152	149	75	59	30	16	15	21	14
Noon	30	28	56	136	163	75	17	14	11	Noon	161	100	65	57	49	35	21	34	10
13	19	25	35	94	179	111	35	19	9	13	151	68	44	45	54	36	40	60	14
14	17	13	20	52	170	165	68	17	6	14	118	50	25	33	50	80	81	72	24
15	8	7	12	45	138	191	97	22	5	15	100	33	18	29	40	81	125	91	16
16	10	6	13	51	142	166	103	22	8	16	83	20	19	24	43	74	143	100	27
17	8	6	10	51	140	168	99	25	20	17	60	13	15	28	35	72	126	105	79
18	5	5	11	63	153	134	77	15	64	18	32	11	17	27	33	49	67	80	197
19	3	6	15	83	140	104	65	15	97	19	35	11	16	37	29	35	75	77	217
20	8	10	23	94	146	85	52	8	103	20	36	14	20	41	31	45	76	73	198
21	3	13	32	116	141	74	45	8	98	21	27	15	24	45	40	39	70	68	205
22	9	17	33	127	134	62	28	12	107	22	44	16	30	46	39	33	53	54	218
23	7	16	39	135	138	56	29	10	101	23	40	15	30	51	38	27	46	45	241
Total	332	484	1208	2910	3104	1859	974	297	1516	Total	1879	1082	996	1101	870	874	1352	1386	3186
Per cent.	2·6	3·8	9·5	22·9	24·5	14·7	7·7	2·3	12·0	Per cent.	14·8	8·5	7·8	8·7	6·8	6·9	10·6	10·9	25·0

TABLE 2.—*Number of winds recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years*—concld.

Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
	NOVEMBER.										DECEMBER.								
0	64	9	11	10	12	9	67	96	244	0	77	15	7	3	3	16	79	114	218
1	80	16	13	9	12	7	60	97	226	1	100	21	7	2	4	16	76	114	193
2	97	18	14	5	12	11	50	89	225	2	112	23	11	1	6	14	66	107	193
3	104	26	11	8	12	7	50	85	218	3	126	32	9	2	2	20	64	110	166
4	117	31	14	11	12	9	57	84	186	4	137	35	8	2	2	17	70	98	162
5	121	34	10	12	13	9	54	73	195	5	154	40	5	2	3	15	58	89	165
6	129	37	17	13	10	8	56	73	177	6	160	46	4	1	2	20	60	90	145
7	134	49	19	10	11	8	60	71	158	7	162	43	4	3	2	17	53	92	133
8	137	72	21	11	11	10	70	80	110	8	169	55	6	2	3	19	59	92	124
9	130	141	32	10	9	11	55	60	45	9	163	114	9	3	2	18	52	89	83
10	194	194	30	7	4	5	26	31	25	10	247	191	14	6	3	7	23	29	28
11	182	188	52	11	6	6	25	29	19	11	180	214	49	5	3	5	17	37	24
Noon	202	126	50	22	9	10	25	57	21	Noon	211	161	47	9	6	12	17	53	15
13	167	87	36	25	17	23	50	96	18	13	205	92	26	18	20	23	43	96	10
14	134	44	28	17	24	36	107	106	19	14	140	49	18	33	25	48	116	108	13
15	88	21	22	8	16	45	164	129	19	15	94	31	11	2	15	67	165	127	14
16	67	14	14	7	11	35	173	148	44	16	62	19	10	...	6	62	203	134	27
17	43	12	10	9	9	26	140	150	119	17	46	14	7	2	5	44	180	148	85
18	37	11	8	8	8	16	110	133	158	18	34	8	7	1	2	30	156	137	158
19	30	14	9	9	13	15	114	134	181	19	37	9	5	1	3	31	153	133	161
20	31	10	7	10	10	10	92	123	228	20	31	14	6	1	2	18	129	126	206
21	33	10	11	8	12	12	87	122	226	21	35	13	5	2	3	21	115	119	220
22	30	9	10	6	14	8	75	103	246	22	49	11	5	2	5	18	88	103	226
23	51	9	9	8	13	14	63	99	256	23	72	17	5	3	5	21	83	115	212
Total	2422	1184	458	254	280	350	1830	2268	3303	Total	2758	1267	285	86	132	579	2135	2476	2796
Per cent.	19'5	9'5	3'7	2'0	2'3	2'8	14'7	18'2	27'3	Per cent.	22'0	9'9	2'2	0'7	1'0	4'5	16'7	19'4	23'5

TABLE 3.—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years*

January.									February								
Hour.	N	NE.	E.	SE.	S.	SW	W.	NW	Hour.	N	NE	E.	SE.	S	SW	W.	NW
0	120	20	11	20	25	29	95	157	0	57	11	14	60	71	39	104	92
1	169	34	10	19	31	34	85	162	1	91	24	17	103	68	26	104	91
2	229	32	20	24	33	27	73	128	2	93	32	30	111	56	23	87	82
3	255	39	31	22	14	15	83	121	3	113	33	47	107	64	23	80	86
4	262	65	32	23	12	22	79	125	4	162	44	53	75	51	34	83	94
5	284	84	35	19	16	21	72	92	5	156	52	46	85	44	25	80	86
6	328	95	34	15	18	16	73	118	6	166	55	52	74	41	23	84	81
7	327	115	38	23	15	13	58	111	7	168	85	63	62	40	25	78	72
8	324	128	42	17	22	18	73	109	8	161	117	96	82	45	20	80	88
9	367	237	57	20	13	20	71	105	9	197	161	71	50	68	36	87	102
10	434	396	84	14	5	14	53	48	10	332	280	84	61	83	37	59	78
11	331	543	135	27	29	18	44	57	11	283	357	139	89	168	75	48	51
Noon	411	385	131	43	73	74	66	112	Noon	344	241	105	108	247	177	88	104
13	455	180	82	67	107	155	196	248	13	271	113	108	81	306	361	269	175
14	341	95	30	75	130	321	550	378	14	196	66	47	44	293	505	682	307
15	183	37	13	39	102	395	1001	462	15	126	44	41	35	240	538	982	363
16	101	24	8	12	68	334	1062	545	16	70	32	31	30	214	482	1069	409
17	61	20	7	8	50	197	781	424	17	30	24	24	26	191	394	795	406
18	34	13	8	9	20	99	409	264	18	21	18	18	22	133	230	434	216
19	25	12	6	14	13	60	386	251	19	28	9	18	24	96	155	351	182
20	31	15	4	17	14	46	357	244	20	28	10	12	31	75	107	361	208
21	41	11	6	16	11	43	265	196	21	24	13	14	36	86	82	266	168
22	66	15	8	18	29	38	155	169	22	49	14	9	53	100	62	195	154
23	90	12	5	23	19	27	104	173	23	56	21	14	90	94	37	139	176
Total	5269	2647	837	584	869	2036	6191	4799	Total	3222	1851	1153	1545	2894	3517	6525	3811
Per cent.	22·7	11·4	3·6	2·5	3·7	8·8	26·6	20·7	Per cent.	13·1	7·5	4·7	6·3	11·8	14·3	26·9	15·5

TABLE 3.—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years*—contd.

MARCH.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
0	24	44	67	481	479	133	128	68
1	41	38	84	459	439	81	92	83
2	43	32	127	467	355	68	91	58
3	55	41	120	455	323	42	79	71
4	72	54	148	479	303	48	60	71
5	77	60	160	506	249	34	82	46
6	69	49	166	539	234	28	75	55
7	75	68	179	597	228	44	53	45
8	81	82	237	729	283	52	70	56
9	87	120	247	763	424	45	52	64
10	220	185	275	506	707	151	54	43
11	177	151	157	376	1217	451	99	78
Noon	159	81	117	232	1353	915	201	122
13	107	51	90	120	1258	1302	493	167
14	78	35	53	111	1098	1514	743	213
15	31	49	57	79	1053	1526	962	272
16	6	35	67	84	977	1436	969	280
17	13	30	62	85	858	1233	828	244
18	6	32	42	108	693	907	519	170
19	8	29	46	122	578	593	393	153
20	15	53	50	173	496	416	288	133
21	25	32	63	234	459	306	254	125
22	30	32	96	277	466	239	171	87
23	36	26	60	458	457	132	119	66
Total	1535	1309	2770	8440	14957	11700	6915	2780
Per cent.	3·0	2·8	5·5	16·7	29·1	23·2	13·7	5·5

APRIL.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W	W.	N.W.
0	47	84	204	616	791	204	75	58
1	39	119	150	718	674	109	103	60
2	40	104	180	753	603	101	66	30
3	36	120	208	683	547	64	51	36
4	23	122	230	688	513	61	59	34
5	27	89	234	689	460	55	45	42
6	17	85	229	787	449	60	68	33
7	37	89	231	991	501	59	62	30
8	41	97	245	1469	761	75	75	39
9	55	95	224	1186	1056	95	84	40
10	113	110	242	560	1721	341	72	54
11	94	104	161	368	2364	836	112	58
Noon	99	60	92	225	2349	1404	216	62
13	83	31	73	102	2256	1957	425	68
14	85	27	62	119	2037	2119	550	98
15	87	23	59	135	1904	2154	648	125
16	99	12	57	119	1791	2112	643	129
17	67	42	49	152	1718	1852	607	120
18	72	23	49	143	1480	1585	443	138
19	40	74	78	194	1192	931	333	77
20	73	67	91	250	1081	382	208	58
21	57	67	150	301	996	464	159	106
22	80	99	136	426	933	357	113	56
23	97	101	143	603	856	280	127	93
Total	1368	1844	3577	12249	29039	17639	5347	1884
Per cent.	2·1	2·5	4·9	16·6	39·9	24·2	7·3	2·5

TABLE 3—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years*—contd

MAY.									JUNE.								
Hour.	N	N.E.	E.	S.E	S.	S W	W.	N W.	Hour.	N.	N E.	E.	S E.	S.	S W.	W.	N W.
0	58	64	245	605	604	191	97	21	0	9	58	189	1100	672	82	25	13
1	42	84	246	625	520	170	113	27	1	17	60	188	1077	648	87	38	8
2	43	83	331	661	502	141	78	46	2	21	72	248	1008	582	57	28	12
3	42	82	379	659	425	118	48	37	3	16	58	279	999	525	33	20	13
4	31	72	395	678	382	109	76	47	4	16	90	313	996	481	52	22	7
5	20	125	402	605	349	93	57	28	5	17	58	355	976	473	69	36	7
6	43	102	393	673	381	93	48	27	6	6	83	348	934	451	94	18	10
7	26	120	449	801	418	110	47	23	7	8	83	380	1167	535	79	29	15
8	30	138	499	1153	571	122	61	12	8	1	82	430	1371	809	89	45	7
9	14	104	426	1089	694	90	37	16	9	2	59	350	1342	658	90	41	8
10	81	151	430	807	1056	166	70	37	10	60	121	348	1425	905	129	41	4
11	79	96	269	681	1614	504	100	39	11	41	57	270	1444	1389	351	56	9
Noon	48	73	184	483	1889	996	174	41	Noon	28	74	215	1211	1696	673	62	26
13	15	54	187	356	1877	1411	304	22	13	30	62	166	990	1834	904	102	21
14	15	52	164	309	1703	1661	456	26	14	14	60	102	813	2095	1264	117	20
15	42	49	135	252	1559	1670	651	40	15	2	49	109	806	1895	1314	245	25
16	20	63	113	331	1432	1613	767	29	16	13	57	134	761	1893	1194	238	39
17	12	57	115	366	939	1100	618	46	17	9	53	149	814	1734	989	209	14
18	32	36	169	347	1141	1080	417	40	18	3	55	148	940	1540	751	162	17
19	62	62	167	307	958	677	226	37	19	1	54	143	990	1252	434	102	15
20	47	62	149	390	804	456	136	24	20	16	55	173	1094	984	202	58	13
21	41	60	158	438	758	347	112	32	21	10	50	184	1124	924	165	46	8
22	53	88	189	531	634	233	120	44	22	2	49	236	1087	838	90	40	10
23	36	73	208	614	611	265	89	29	23	5	44	201	1148	746	68	36	11
Total	933	1950	6402	13761	21821	13416	4902	770	Total	347	1543	5638	25617	23559	9350	1825	332
Per cent.	1'5	3'0	10'0	21 5	34'1	21'0	7'7	1'2	Per cent.	0'5	2'2	8 0	36 5	30'4	13 3	2'6	0'5

TABLE 3.—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years*—contd.

July.									August.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
0	8	14	181	1521	918	79	17	0	0	1	6	116	1063	835	73	15	0
1	5	12	167	1428	821	121	32	9	1	1	7	131	1054	824	70	10	0
2	0	11	200	1345	817	100	33	6	2	5	7	123	1118	750	59	8	0
3	4	10	249	1232	693	105	53	4	3	3	13	179	917	648	78	17	2
4	7	30	299	1197	671	95	55	7	4	4	22	226	942	592	103	25	5
5	6	42	317	1163	549	75	73	0	5	4	35	220	921	534	80	13	1
6	4	40	346	1155	552	101	49	3	6	2	35	265	976	503	70	15	1
7	8	51	393	1315	603	103	63	4	7	3	45	307	1051	594	82	21	1
8	3	33	494	1667	744	135	46	4	8	6	50	395	1352	744	85	22	1
9	5	21	376	1641	787	145	25	3	9	1	41	325	1443	746	79	7	4
10	66	96	537	1722	900	148	30	0	10	47	135	459	1474	756	76	8	1
11	43	36	286	1933	1579	270	42	0	11	37	42	200	1664	1359	165	25	5
Noon	26	20	189	1616	2039	576	92	11	Noon	34	41	150	1350	1838	431	30	3
13	5	15	115	1342	2236	1000	79	10	13	36	15	79	1038	2132	899	62	5
14	4	9	108	1019	2592	1198	106	18	14	9	6	50	801	2205	1290	125	17
15	0	10	56	892	2632	1256	148	10	15	4	2	25	679	2213	1434	215	7
16	4	2	60	1001	2519	1294	141	5	16	5	4	23	628	2130	1454	189	14
17	4	3	57	1004	2378	1115	95	2	17	0	3	32	650	1985	1249	138	6
18	0	5	76	1171	2171	869	80	2	18	0	5	43	730	1809	833	120	4
19	0	0	97	1292	1740	553	62	1	19	0	3	46	941	1477	478	85	9
20	0	0	104	1452	1452	304	53	1	20	2	5	76	1064	1150	249	36	2
21	2	1	133	1487	1325	197	32	3	21	6	7	73	1204	1135	145	20	5
22	15	6	158	1559	1201	170	20	3	22	2	34	163	1155	998	90	17	1
23	11	3	153	1481	1046	89	17	0	23	1	10	119	1056	925	100	10	1
Total	230	470	5061	32650	32965	10118	1443	108	Total	213	573	3579	25561	22953	4695	1266	93
Per cent.	0·3	0·6	6·1	39·3	39·7	12·2	1·7	0·1	Per cent.	0·3	0·8	5·5	39·2	41·3	13·5	1·8	0·1

TABLE 3.—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years*—contd.

September.									October								
Hour.	N.	NE	E	SE	S.	SW.	W	NW	Hour.	N	NE	E.	SE	S.	S.W.	W.	N.W
0	15	44	127	508	380	90	28	14	0	88	58	101	135	89	31	66	51
1	10	38	117	492	413	76	29	12	1	80	44	110	159	97	42	64	58
2	9	32	142	476	300	69	36	9	2	91	30	99	168	74	39	62	66
3	9	39	185	479	241	78	38	8	3	93	36	106	153	77	28	64	73
4	19	45	176	515	259	76	26	11	4	97	57	116	150	82	32	71	78
5	10	54	190	480	233	58	35	11	5	118	69	142	140	74	33	61	68
6	11	47	207	484	239	66	38	11	6	102	83	141	153	71	36	55	60
7	17	79	292	527	285	92	50	12	7	123	89	183	169	95	36	60	80
8	40	109	386	724	335	67	47	19	8	230	190	250	215	101	45	73	93
9	43	109	327	859	393	53	46	13	9	204	358	266	230	90	38	48	75
10	125	240	389	841	404	65	36	18	10	331	413	198	179	107	28	37	42
11	102	114	294	923	747	157	44	26	11	366	344	214	272	161	58	28	51
Noon	70	65	209	817	1016	414	61	44	Noon	387	218	176	234	253	159	53	80
13	55	50	123	584	1205	701	150	52	13	381	143	104	214	297	269	132	165
14	53	32	56	366	1264	1088	309	76	14	281	97	70	170	266	411	340	238
15	36	13	34	333	1091	1301	462	98	15	238	63	50	176	227	445	574	316
16	24	14	36	352	1092	1188	473	86	16	192	46	71	125	213	380	575	339
17	18	14	38	357	933	969	373	66	17	106	24	49	132	130	250	378	230
18	16	11	42	356	804	545	222	28	18	53	30	49	120	101	136	187	145
19	6	36	68	401	584	278	125	34	19	63	28	33	158	78	69	103	163
20	21	33	84	429	529	180	85	12	20	69	35	64	153	97	95	174	136
21	6	33	109	523	460	133	76	16	21	45	39	81	153	120	86	130	111
22	18	50	121	518	412	108	45	21	22	77	36	100	166	95	63	99	95
23	15	44	108	513	495	91	43	14	23	66	38	83	177	84	44	75	69
Total	748	1345	3860	12857	14024	7943	2877	711	Total	3881	2608	2876	4103	3079	2852	3508	2883
Per cent.	1·7	3·0	8·7	29·0	31·6	17·9	6·5	1·6	Per cent.	15·0	10·1	11·1	15·9	11·9	11·0	13·8	11·2

TABLE 3.—*Number of miles recorded under each octant of the compass at each hour in each month of the year at Chittagong during 17-18 years*—concld.

November.									December.								
Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Hour.	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.
0	100	15	18	16	21	22	97	146	0	133	31	13	9	5	24	102	167
1	144	24	21	27	18	18	89	143	1	165	30	18	5	4	23	101	170
2	160	29	17	12	24	23	64	133	2	213	42	17	3	6	20	85	163
3	182	47	16	17	25	11	64	129	3	234	56	20	2	3	27	55	159
4	204	50	21	22	26	12	71	122	4	245	80	24	5	3	22	96	116
5	205	58	29	20	18	12	70	110	5	281	60	21	11	4	23	83	125
6	223	77	35	21	13	12	70	100	6	314	84	10	4	6	27	85	134
7	232	91	33	19	19	11	77	101	7	316	89	8	8	2	26	75	129
8	280	106	48	18	21	14	96	122	8	328	120	11	15	4	30	83	143
9	268	362	78	29	18	20	93	109	9	312	275	27	16	4	38	72	136
10	374	484	94	27	17	16	55	65	10	486	552	51	23	8	15	43	55
11	440	455	138	35	23	13	54	65	11	387	580	121	20	5	7	33	76
Noon	502	258	112	65	33	33	70	140	Noon	530	381	121	31	22	30	37	135
13	365	162	89	63	67	95	185	266	13	509	217	63	59	74	102	148	280
14	325	98	72	54	94	162	449	331	14	343	114	30	38	93	250	516	334
15	198	43	67	43	60	201	718	503	15	236	72	24	8	68	334	757	508
16	144	24	39	57	37	145	670	540	16	147	34	22	0	22	258	865	592
17	62	17	24	48	37	58	334	368	17	80	15	13	5	9	114	423	435
18	53	22	18	26	36	29	208	311	18	49	15	13	1	4	54	314	208
19	48	32	20	22	59	29	216	313	19	58	17	14	2	5	53	357	310
20	53	18	12	30	42	17	202	285	20	46	22	21	2	4	31	269	269
21	57	20	15	23	44	21	158	246	21	50	20	13	13	4	25	199	232
22	75	10	21	15	46	13	112	173	22	69	18	11	7	16	28	142	169
23	74	22	18	14	21	38	87	142	23	103	29	6	7	13	30	114	177
Total	4788	2584	1055	723	839	1025	4309	4963	Total	5632	2973	700	267	368	1579	5176	5547
Per cent.	236	127	52	36	42	51	212	243	Per cent.	255	135	32	12	18	72	235	252

TABLE 4.—*Number of miles recorded under each octant of the compass in each month of the year at Chittagong during 17-18 years.*

Month.	N.	N.E.	E.	S.E.	S	S.W.	W.	N.W.	Total.
January	5269	2647	837	584	869	2036	6891	4799	23232
February	3222	1851	1153	1545	2894	3517	6625	3811	24618
March	1535	1399	2770	8440	14987	11700	6915	2780	50526
April	1508	1844	3577	12249	29159	17639	5349	1684	73009
May	932	1950	6402	13761	21821	13416	4902	770	63954
June	347	1543	5638	25617	25559	9350	1825	332	70211
July	230	470	5061	32650	32965	10118	1443	108	83045
August	213	573	3879	25381	28953	9695	1266	98	70058
September	748	1345	3860	12857	14024	7943	2877	711	44365
October	3881	2608	2876	4103	3079	2852	3568	2883	25850
November	4788	2584	1055	723	839	1025	4309	4963	20286
December	5632	2973	700	287	388	1579	5186	5349	22094
Sum	28305	21787	37808	138197	175537	90870	50456	28288	571248
Percentage	5·0	3·8	6·6	24·2	30·7	15·9	8·8	4·9	99·9

TABLE 5 — *Mean co-ordinates of the wind movement in each hour of each month at Chittagong as registered by a Beckley's anemograph from June 1879 to December 1896.*

	January.		February.		March.		April		May.		June.		July.		August		September		October		November		December	
	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E	N	E
Midnight to 1 .	+0·50	−0·37	+0·03	−0·18	−1·47	+0·48	−2·33	+1·03	−1·98	+1·02	−3·00	+1·39	−3·55	+1·99	−2·93	+1·52	−1·45	+0·75	−0·16	+0·22	+0·11	−0·28	+0·53	−0·37
1 to 2 .	+0·60	−0·23	+0·15	−0·07	−1·32	+0·63	−2·26	+1·28	−1·92	+1·33	−2·72	+1·93	−3·10	+1·96	−2·90	+1·61	−1·21	+0·77	−0·09	+0·22	+0·13	−0·25	+0·63	−0·31
2 to 3 .	+0·71	−0·19	+0·09	−0·03	−1·13	+0·69	−1·96	+1·38	−1·75	+1·53	−2·54	+2·08	−3·03	+1·66	−2·51	+1·45	−1·11	+0·85	−0·01	+0·22	+0·50	−0·20	+0·68	−0·30
3 to 4 .	+0·73	−0·18	+0·20	−0·03	−1·09	+0·76	−1·91	+1·42	−1·70	+1·53	−2·43	+2·17	−2·90	+1·04	−2·30	+1·17	−1·16	+0·91	−0·03	+0·21	+0·53	−0·18	+0·67	−0·20
4 to 5 .	+0·75	−0·09	+0·20	−0·01	−1·01	+0·87	−1·82	+1·11	−1·17	+1·60	−2·15	+2·13	−2·50	+1·21	−2·21	+1·52	−1·05	+0·91	+0·03	+0·30	+0·54	−0·11	+0·75	−0·20
5 to 6 .	+0·91	−0·12	+0·25	−0·03	−1·02	+0·95	−1·52	+1·19	−1·62	+1·69	−2·37	+2·03	−2·64	+2·00	−2·28	+1·03	−1·03	+0·91	0	+0·35	+0·03	−0·03	+0·53	−0·21
6 to 7 .	+0·92	−0·02	+0·11	+0·05	−1·12	+1·13	−2·36	+1·83	−1·03	+1·55	−2·68	+2·52	−2·91	+2·28	−2·52	+1·85	−1·19	+1·12	0	+0·12	+0·03	−0·09	+0·85	−0·22
7 to 8 .	+0·03	−0·01	+0·12	+0·18	−1·39	+1·41	−3·60	+2·51	−2·76	+2·50	−3·87	+2·83	−3·73	+2·70	−3·19	+2·12	−1·51	+1·03	+0·27	+0·09	+0·51	−0·03	+0·90	−0·19
8 to 9 .	+1·21	+0·17	+0·02	+0·03	−1·73	+1·65	−3·93	+2·09	−3·14	+2·51	−4·05	+3·03	−3·20	+2·91	−3·67	+2·63	−1·83	+1·85	+0·15	+1·10	+1·11	+0·31	+1·09	+0·05
9 to 10 .	+1·51	+0·58	+0·09	+0·12	−1·06	+1·20	−4·00	+0·79	−3·15	+1·81	−4·06	+2·06	−3·91	+3·16	−3·27	+2·37	−1·39	+2·00	+0·75	+1·09	+1·33	+0·67	+1·61	+0·03
10 to 11 .	+1·35	+0·92	+0·05	+0·72	−3·00	+0·12	−0·90	−0·53	−1·72	+0·09	−5·52	+2·19	−5·70	+2·09	−4·00	+2·11	−2·47	+1·61	+0·17	+1·09	+1·15	+0·72	+1·55	+0·85
11 to noon	+1·20	+0·10	+0·31	+0·15	−3·83	−1·74	−7·21	−2·03	−5·81	−0·03	−6·23	+1·22	−6·53	+1·57	−5·61	+1·17	−3·29	+0·81	+0·12	+0·51	+1·08	+0·23	+1·51	+0·49
Noon to 13 .	+1·03	−0·17	−0·23	−0·06	−1·19	−2·76	−7·51	−3·53	−6·37	−1·75	−6·70	+0·19	−7·15	+0·52	−6·09	+0·23	−3·78	−0·21	−0·07	−0·15	+0·31	−0·37	+1·27	−0·21
13 to 14 .	+0·55	−1·05	−0·50	−2·57	−4·14	−3·78	−7·27	−4·12	−6·29	−2·50	−7·51	−0·63	−7·00	−0·23	−6·70	−0·53	−4·10	−1·51	−0·30	−1·01	+0·71	−1·20	+0·71	−1·15
14 to 15 .	+0·20	−3·19	−0·53	−3·10	−4·05	−4·20	−7·01	−4·33	−5·82	−3·13	−7·15	−1·02	−7·09	−0·71	−6·83	−1·26	−4·06	−2·22	−0·20	−1·03	+0·03	−2·12	+0·61	−2·17
15 to 16 .	+0·10	−3·42	−0·19	−3·03	−3·25	−4·34	−6·05	−4·38	−5·61	−3·17	−6·84	−0·89	−7·65	−0·54	−6·66	−1·10	−4·00	−2·07	−0·20	−1·07	+0·71	−2·05	+0·71	−2·78
16 to 17 .	+0·37	−2·17	−0·35	−2·07	−3·35	−3·05	−6·13	−3·86	−3·89	−2·09	−6·31	−0·33	−7·16	−0·22	−6·21	−1·01	−3·11	−1·53	−0·21	−1·05	+0·43	−1·09	+0·56	−1·09
17 to 18 .	+0·23	−1·33	−0·28	−1·00	−2·67	−2·31	−4·97	−2·83	−4·27	−1·59	−5·72	+0·31	−6·03	+0·39	−5·15	−0·20	−2·65	−0·02	−0·10	−0·13	+0·37	−0·73	+0·11	−1·02
18 to 19 .	+0·30	−1·21	−0·11	−1·25	−2·01	−1·63	−3·00	−1·62	−3·16	−0·63	−4·71	+0·93	−5·01	+1·03	−3·54	+0·52	−1·31	+0·06	−0·09	−0·27	+0·39	−0·77	+0·10	−1·10
19 to 20 .	+0·32	−1·11	+0·02	−1·21	−1·02	−0·03	−3·16	−0·73	−2·09	−0·01	−3·92	+1·65	−5·00	+1·60	−3·02	+1·11	−1·21	+0·20	−0·15	−0·26	+0·37	−0·71	+0·12	−0·51
20 to 21 .	+0·23	−0·35	−0·01	−0·90	−1·52	−0·63	−2·83	−0·32	−2·50	+0·27	−3·81	+1·81	−4·65	+1·97	−2·83	+1·18	−1·17	+0·61	−0·23	−0·10	+0·33	−0·53	+0·77	−0·15
21 to 22 .	+0·26	−0·56	−0·03	−0·67	−1·53	−0·20	−2·76	+0·20	−2·15	+0·65	−3·43	+1·93	−3·16	+2·09	−3·11	+1·70	−1·19	+0·73	−0·15	+0·03	+0·27	−0·79	−0·33	−0·53
22 to 23 .	+0·15	−0·35	−0·08	−0·35	−1·03	+0·30	−2·57	+0·00	−2·33	+0·82	−3·31	+2·03	−3·09	+2·00	−3·03	+1·50	−1·47	+0·73	−0·18	+0·15	+0·25	−0·21	+0·30	−0·13
23 to midnight	+0·25	−0·19	−0·03	−0·00	−1·70	+0·25	−2·52	+0·08	−2·15	+0·27	−2·09	+1·96	−3·78	+2·22	−3·00	+1·19	−1·31	+0·78	−0·03	+0·21	+0·32	−0·11	+0·46	−0·27
Total .	+16·20	−10·23	+1·71	−18·73	−52·17	−15·43	−97·52	−11·14	−77·17	+5·41	−104·52	+25·15	−116·63	+37·23	−76·57	+20·13	−50·32	+9·79	−0·11	+0·07	+15·50	−0·17	+18·18	−13·1
Mean of day .	+0·69	−0·43	+0·07	−0·78	−2·17	−0·65	−4·03	−0·47	−3·00	+0·23	−4·37	+1·16	−4·76	+1·55	−4·11	+1·09	−2·19	+0·53	−0·02	0	+0·65	−0·17	+0·77	−0·56

N and E are in miles per hour, S and W are minus signs.

TABLE 6.—*Hourly co-ordinates of the mean diurnal variation of wind movement at Chittagong from the 17-18 years' registers of a Beckley's anemograph. East and North are designated by +, South and West by — signs.*

Hour.	North and South Components		East and West Components.	
	Observed.	Computed	Observed.	Computed
Midnight to 1	+0·614	+0·570	+0·453	+0·613
1 to 2	+0·726	+0·733	+0·550	+0·641
2 to 3	+0·894	+0·914	+0·583	+0·655
3 to 4	+0·953	+1·028	+0·621	+0·687
4 to 5	+1·047	+1·029	+0·660	+0·749
5 to 6	+1·043	+0·942	+0·696	+0·850
6 to 7	+0·894	+0·825	+0·879	+1·012
7 to 8	+0·517	+0·704	+1·215	+1·233
8 to 9	+0·395	+0·533	+1·356	+1·434
9 to 10	+0·588	+0·224	+1·313	+1·437
10 to 11	−0·356	−0·257	+0·925	+1·044
11 to noon	−0·948	−0·840	+0·063	+0·193
Noon to 13	−1·373	−1·362	−0·995	−0·941
13 to 14	−1·642	−1·662	−2·010	−1·986
14 to 15	−1·586	−1·670	−2·700	−2·566
15 to 16	−1·441	−1·429	−2·726	−2·516
16 to 17	−1·072	−1·048	−2·018	−1·960
17 to 18	−0·746	−0·634	−1·201	−1·210
18 to 19	−0·177	−0·253	−0·684	−0·559
19 to 20	+0·155	+0·059	−0·286	−0·134
20 to 21	+0·222	+0·278	−0·030	+0·106
21 to 22	+0·351	+0·397	+0·231	+0·268
22 to 23	+0·418	+0·442	+0·362	+0·414
23 to midnight	+0·519	+0·478	+0·426	+0·538

WIND ROSES SHOWING THE PERCENTAGE NUMBER OF CALMS AND OF MILES OF WIND IN THE DIFFERENT DIRECTIONS DURING THE MONTHS JANUARY TO JUNE AT CHITTAGONG.

Fig 1.

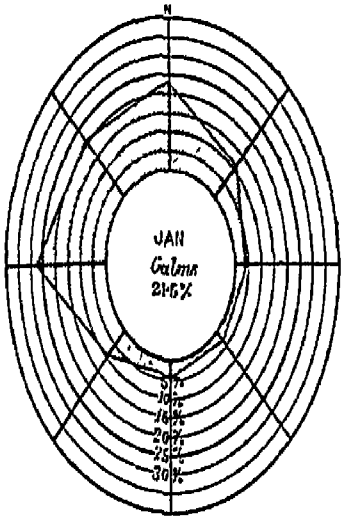


Fig 2.

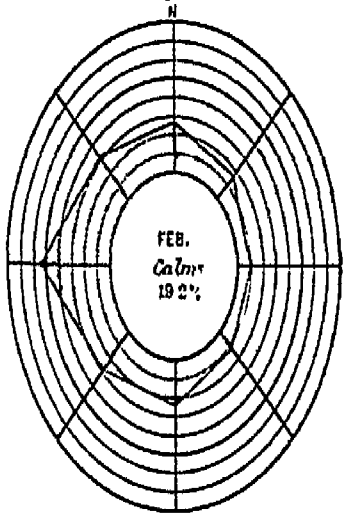


Fig 3

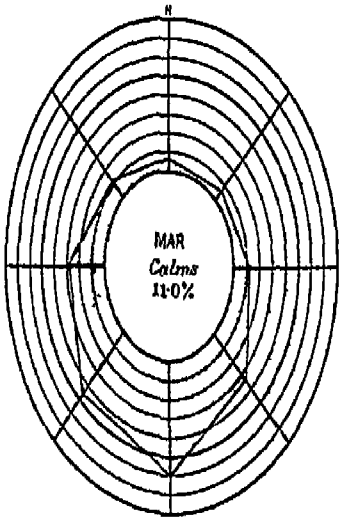


Fig. 4

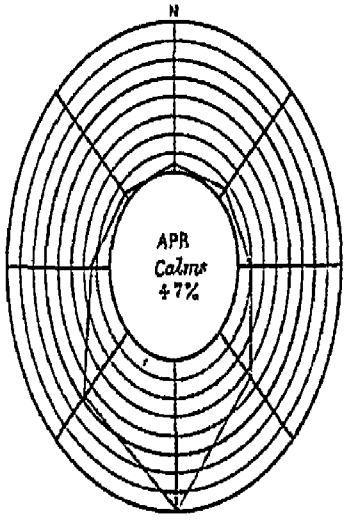


Fig 5.

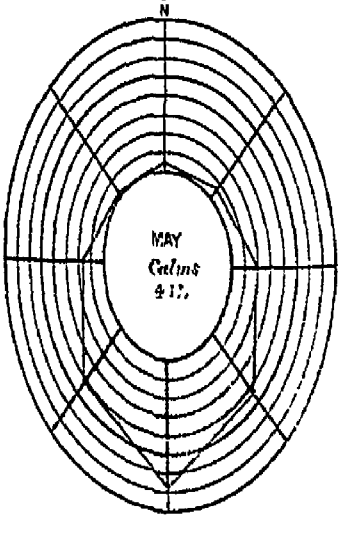
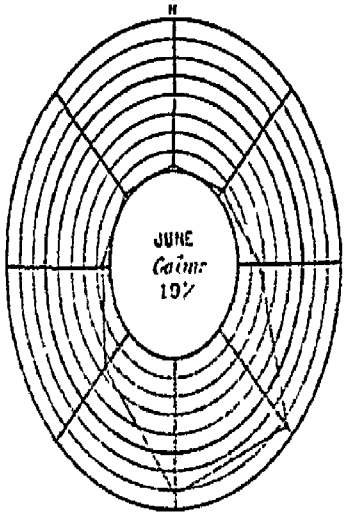


Fig 6.



WIND ROSES SHOWING THE PERCENTAGE NUMBER OF CALMS AND OF MILES OF WIND IN THE DIFFERENT DIRECTIONS DURING THE MONTHS JULY TO DECEMBER AND THE YEAR AT CHITTAGONG

Fig. 1.

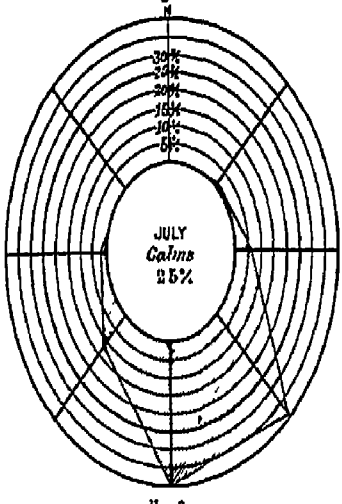


Fig. 2

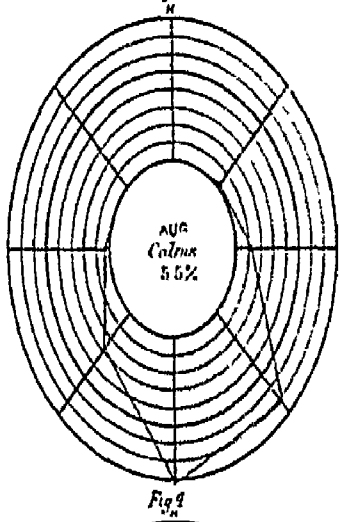


Fig. 3.

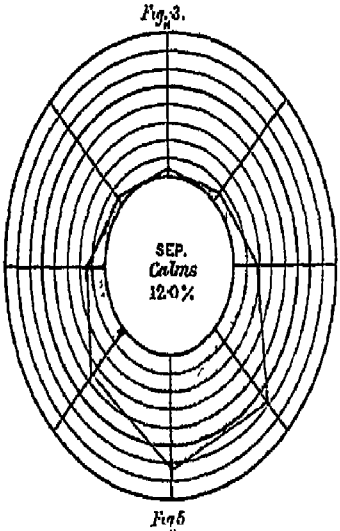


Fig. 4

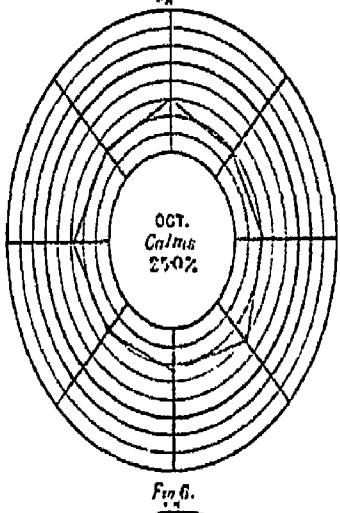


Fig. 5

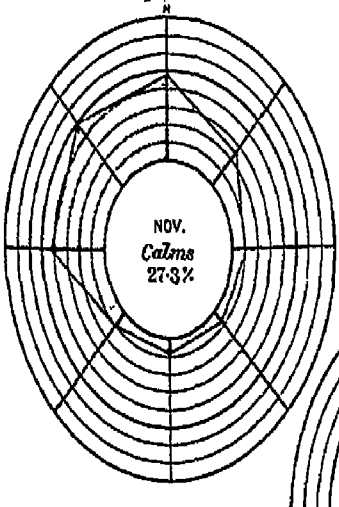


Fig. 6.

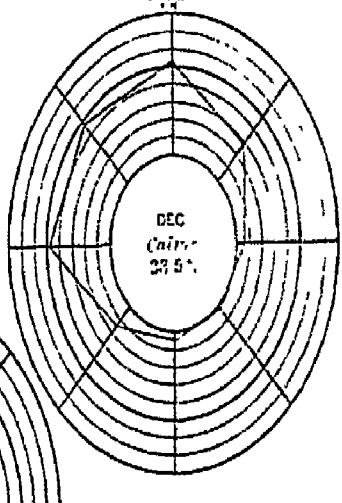
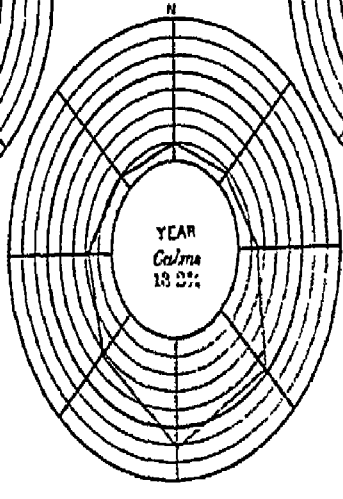
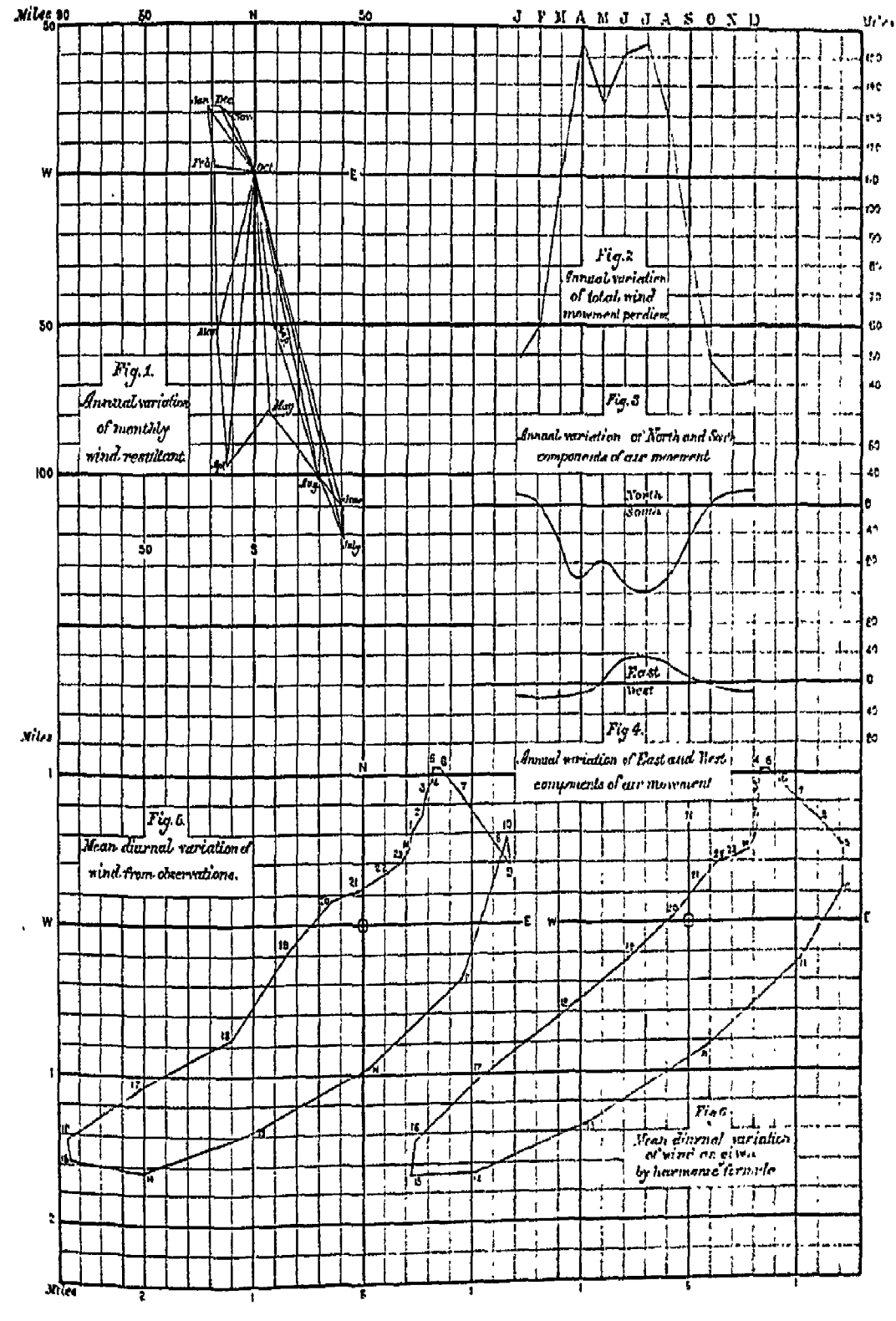


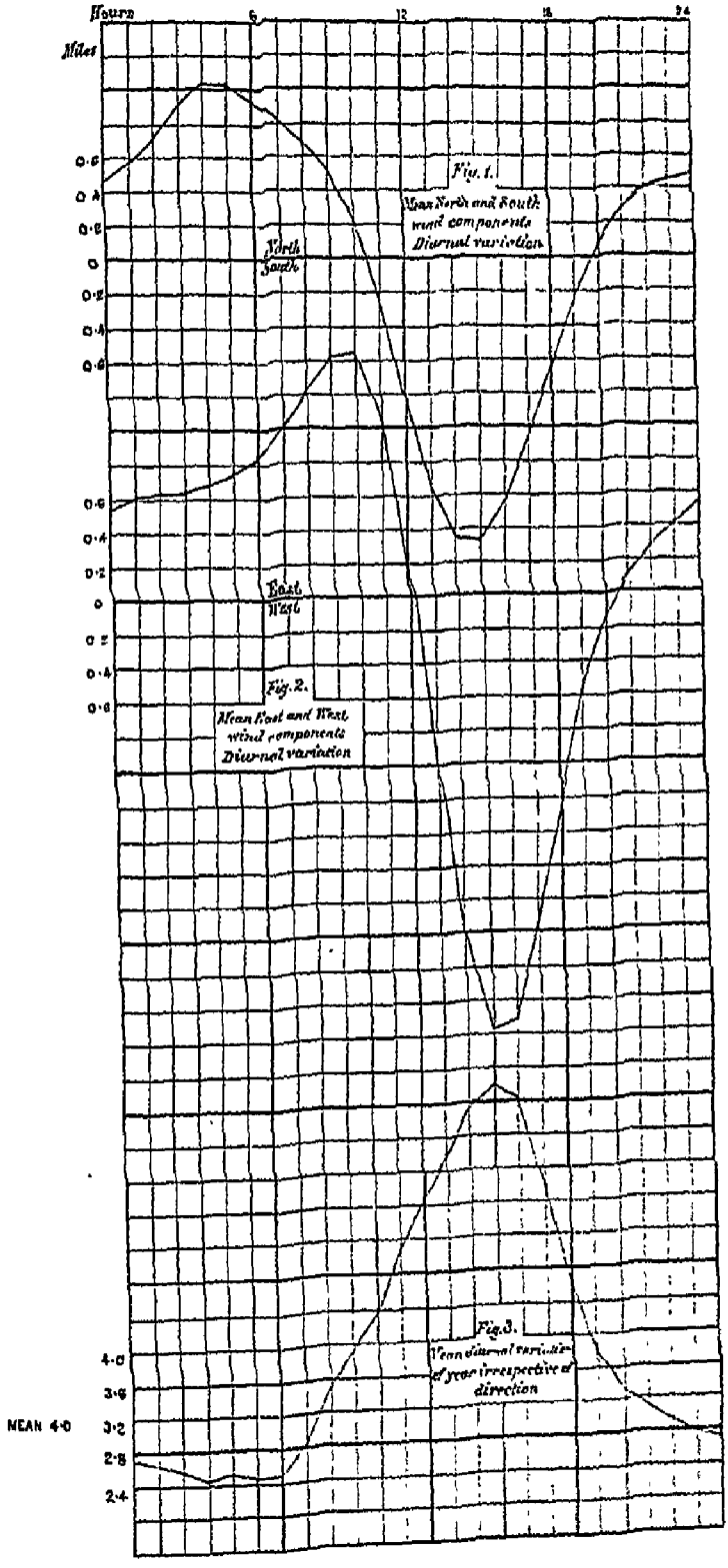
Fig. 7



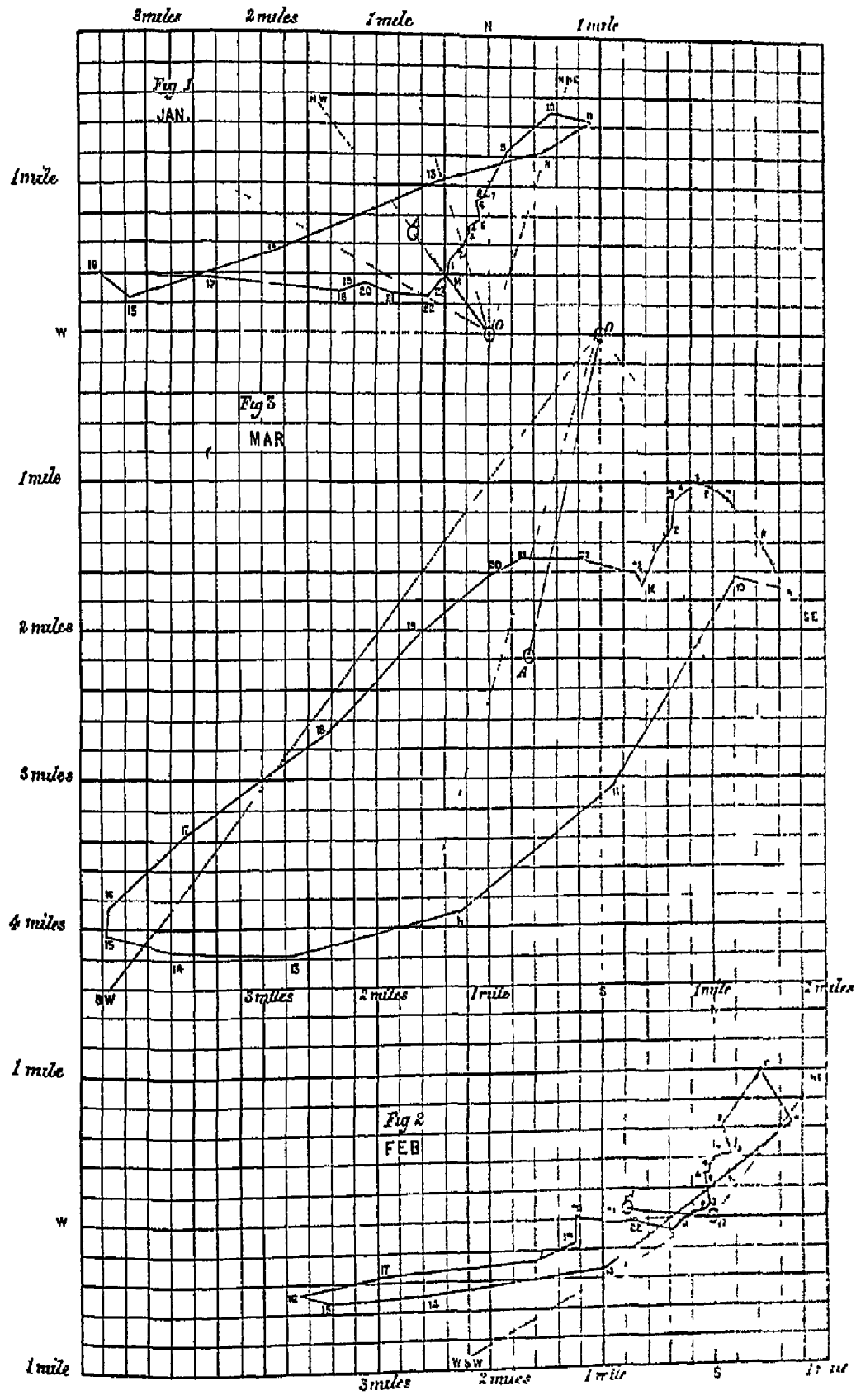
ANNUAL VARIATION, *i.e.* MEANS FOR THE DIFFERENT MONTHS OF THE YEAR, OF (1) THE DAILY RESULTANT AIR MOVEMENT, (2) THE TOTAL DAILY AIR MOVEMENT IRRESPECTIVE OF DIRECTION, (3) THE NORTH AND SOUTH COMPONENTS OF THE RESULTANT DAILY AIR MOVEMENT, AND (4) THE EAST AND WEST COMPONENTS OF THE SAME. ALSO (5) THE MEAN FOR THE YEAR OF THE DAILY VARIATION OF RESULTANT AIR MOVEMENTS DURING SUCCESSIVE HOURS, AND (6) THE SAME AS SMOOTHED BY THE HARMONIC FORMULA.



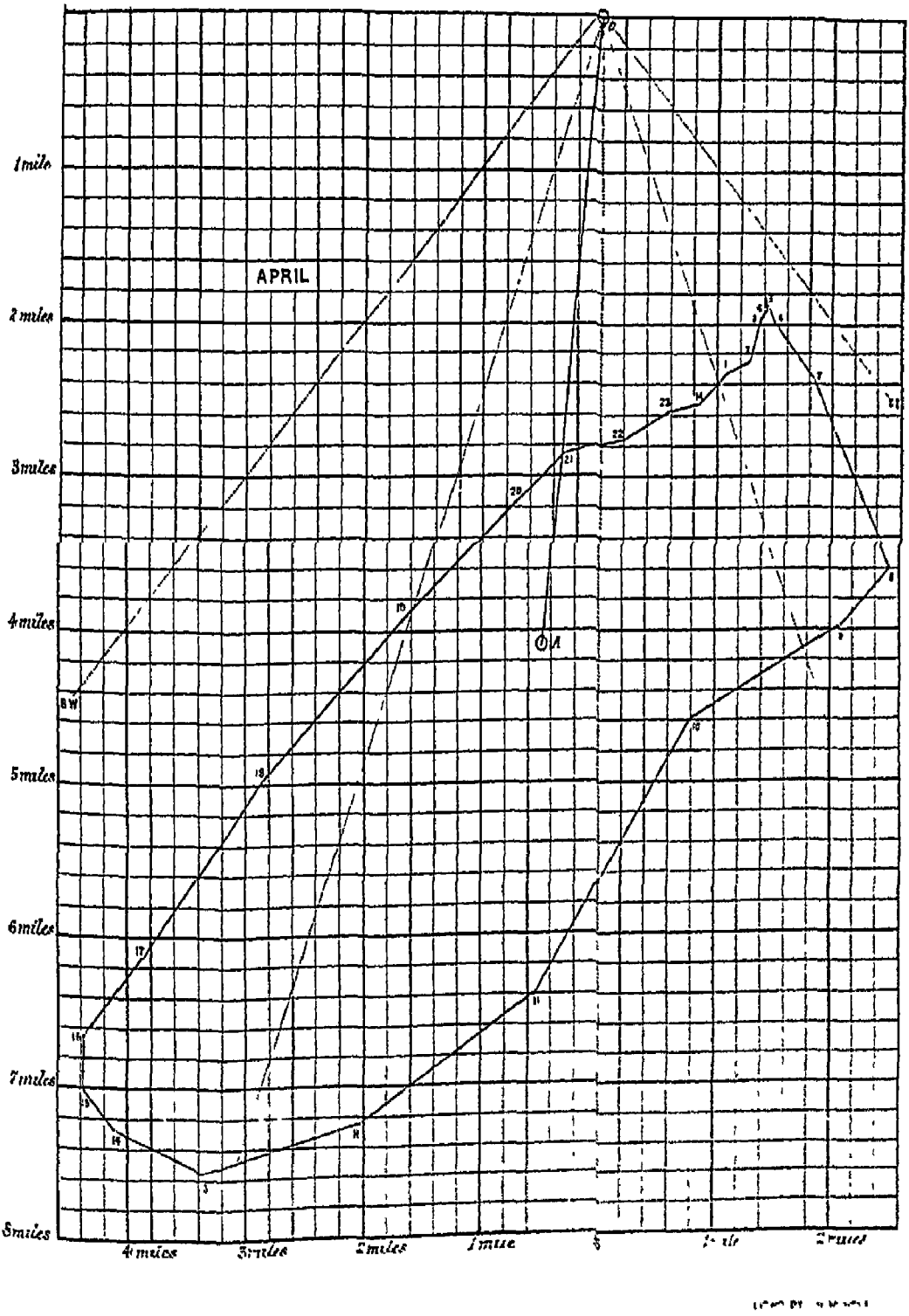
AVERAGES DURING THE YEAR OF (1) THE NORTH-SOUTH COMPONENTS AND (2) THE EAST-WEST COMPONENTS OF THE RESULTANT WIND MOVEMENTS DURING SUCCESSIVE HOURS OF THE DAY; ALSO (3) OF THE WIND MOVEMENT IRRESPECTIVE OF DIRECTION DURING SUCCESSIVE HOURS OF THE DAY.



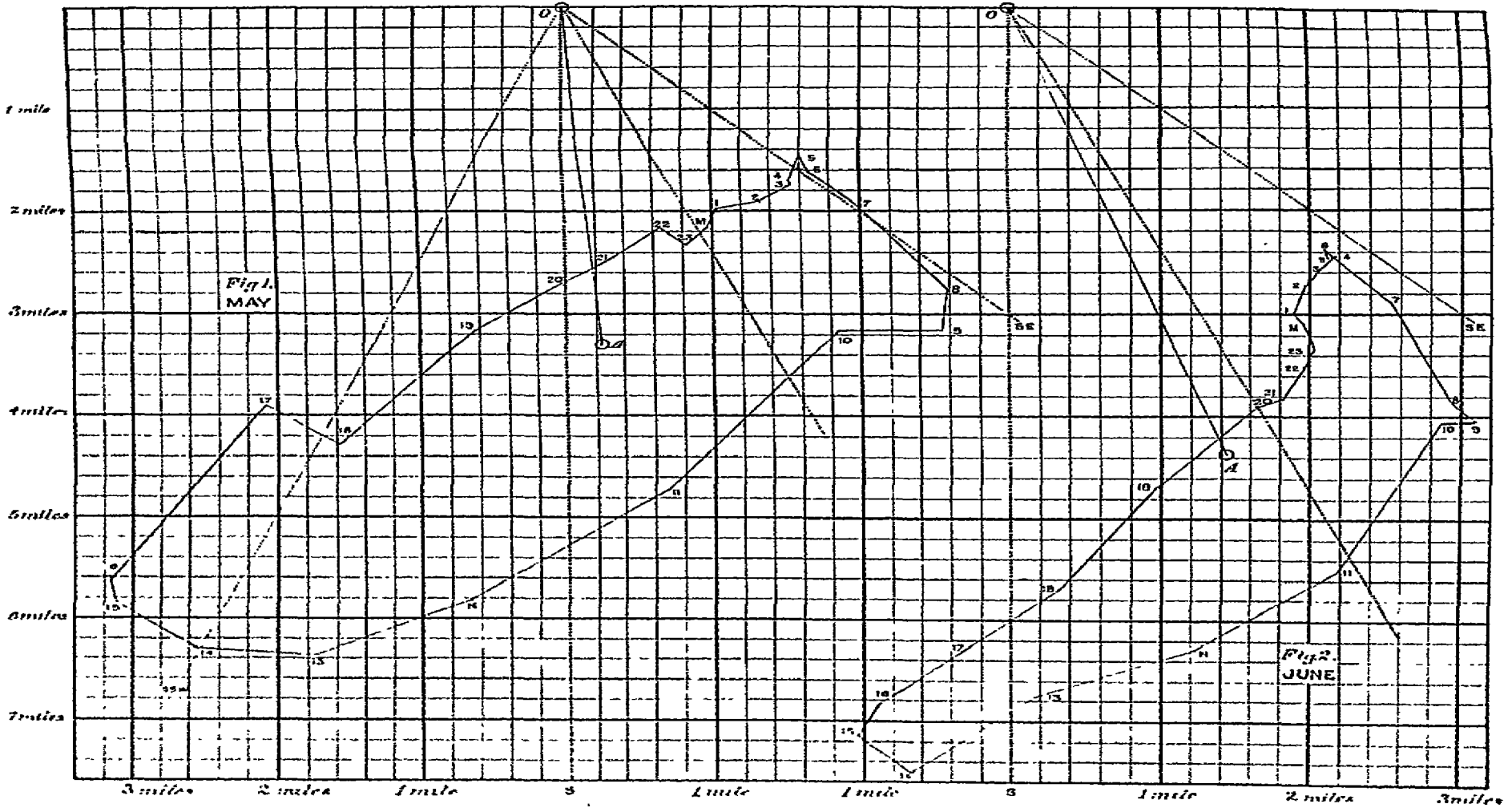
MEAN DIURNAL VARIATION OF THE WIND AT CHITTAGONG IN JANUARY, FEBRUARY AND MARCH, SHOWING THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS



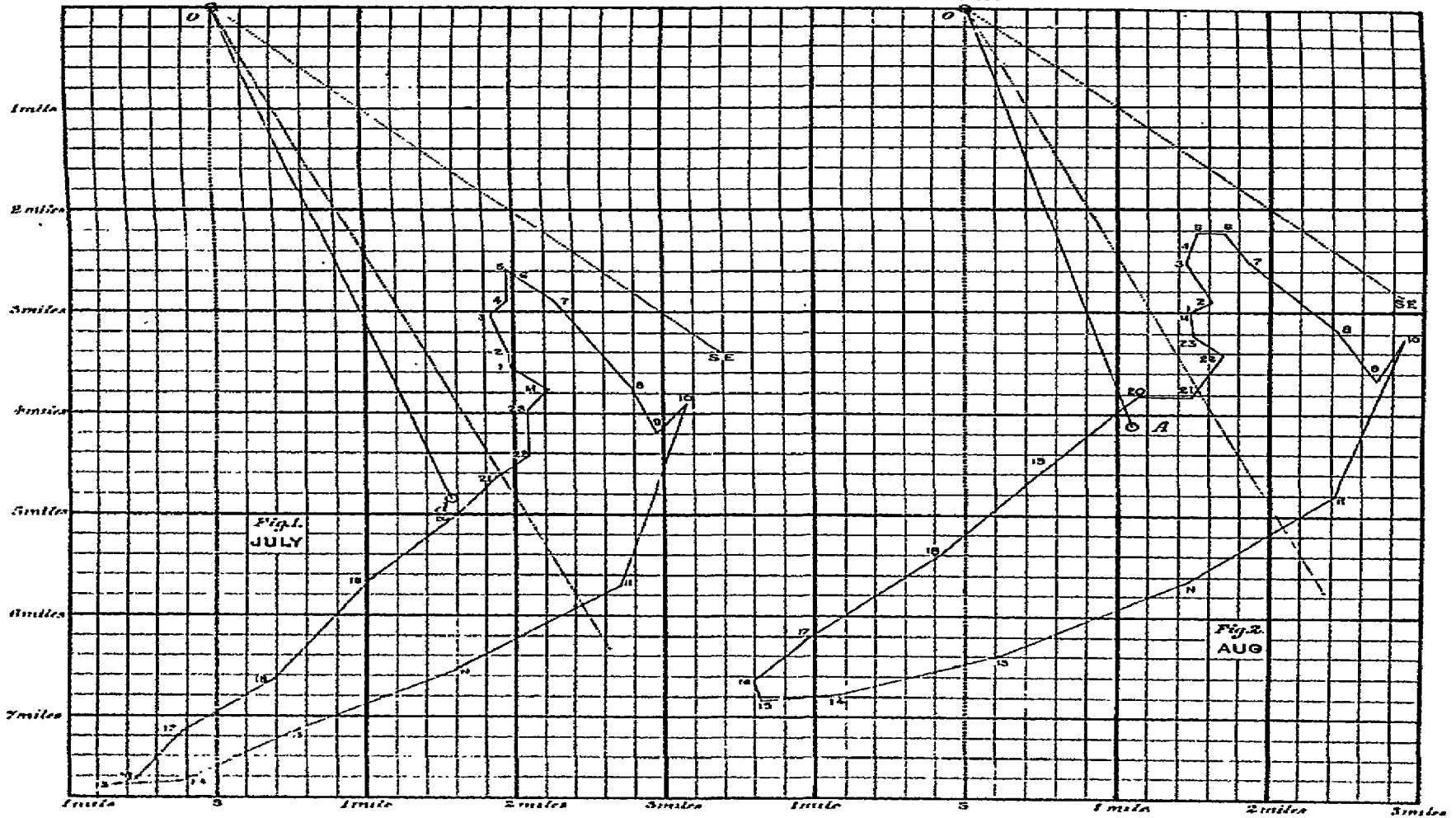
MEAN DIURNAL VARIATION OF THE WIND AT CHITTAGONG IN APRIL, SHOWING THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS.



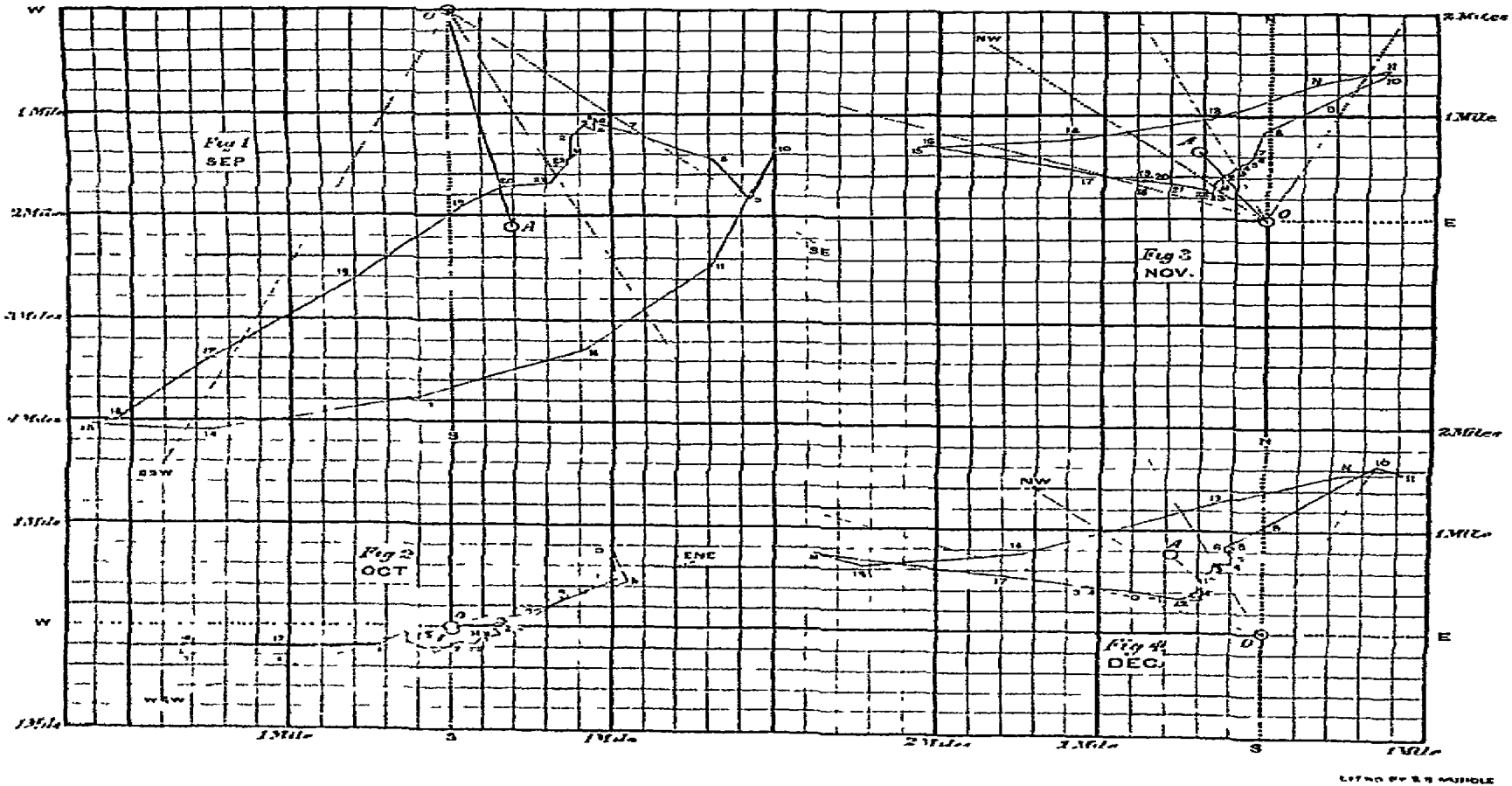
MEAN DIURNAL VARIATION OF THE WIND AT CHITTAGONG IN MAY AND JUNE, SHOWING THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS.



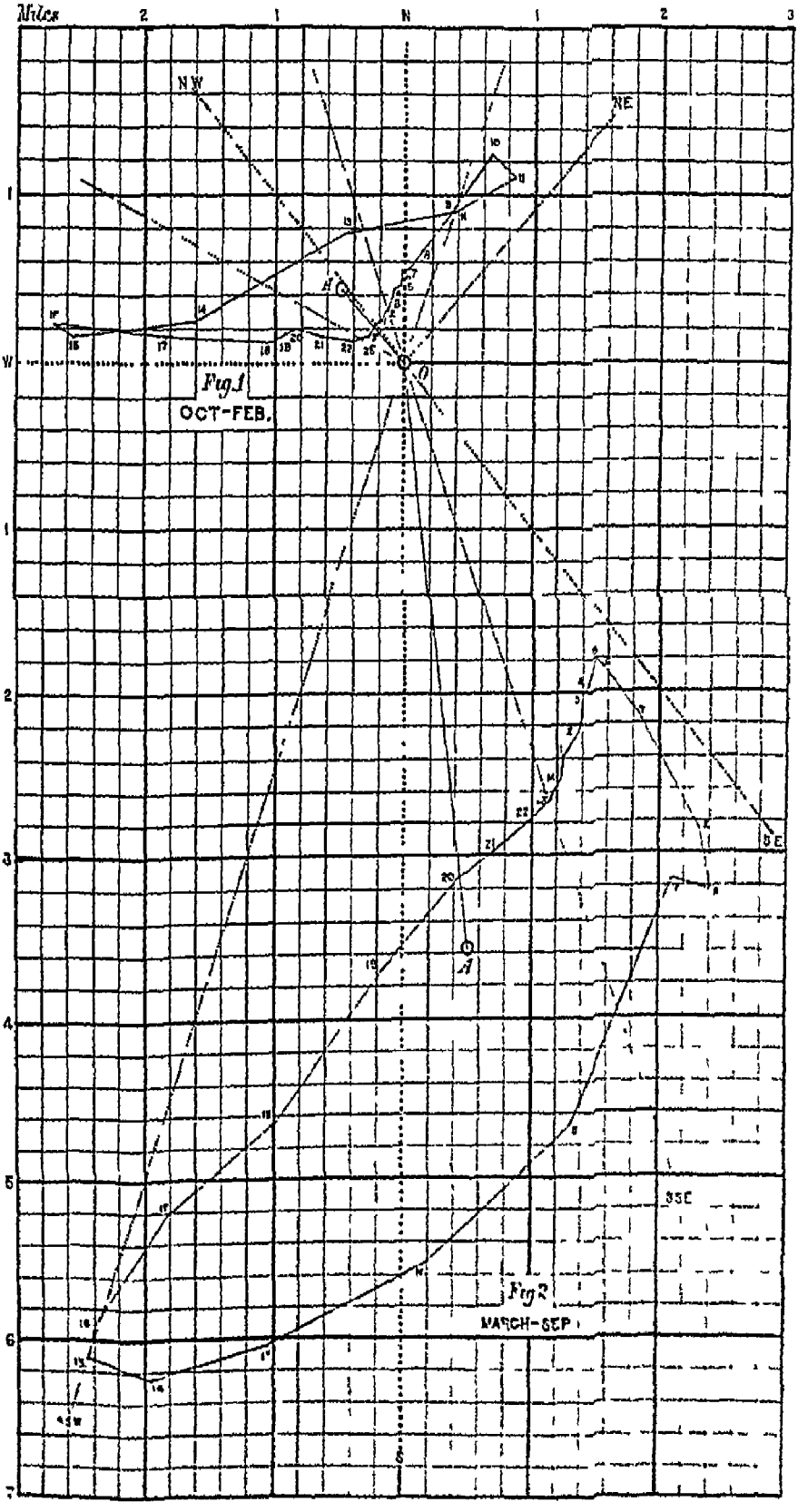
MEAN DIURNAL VARIATION OF THE WIND AT CHITTAGONG IN JULY AND AUGUST, SHOWING THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS.



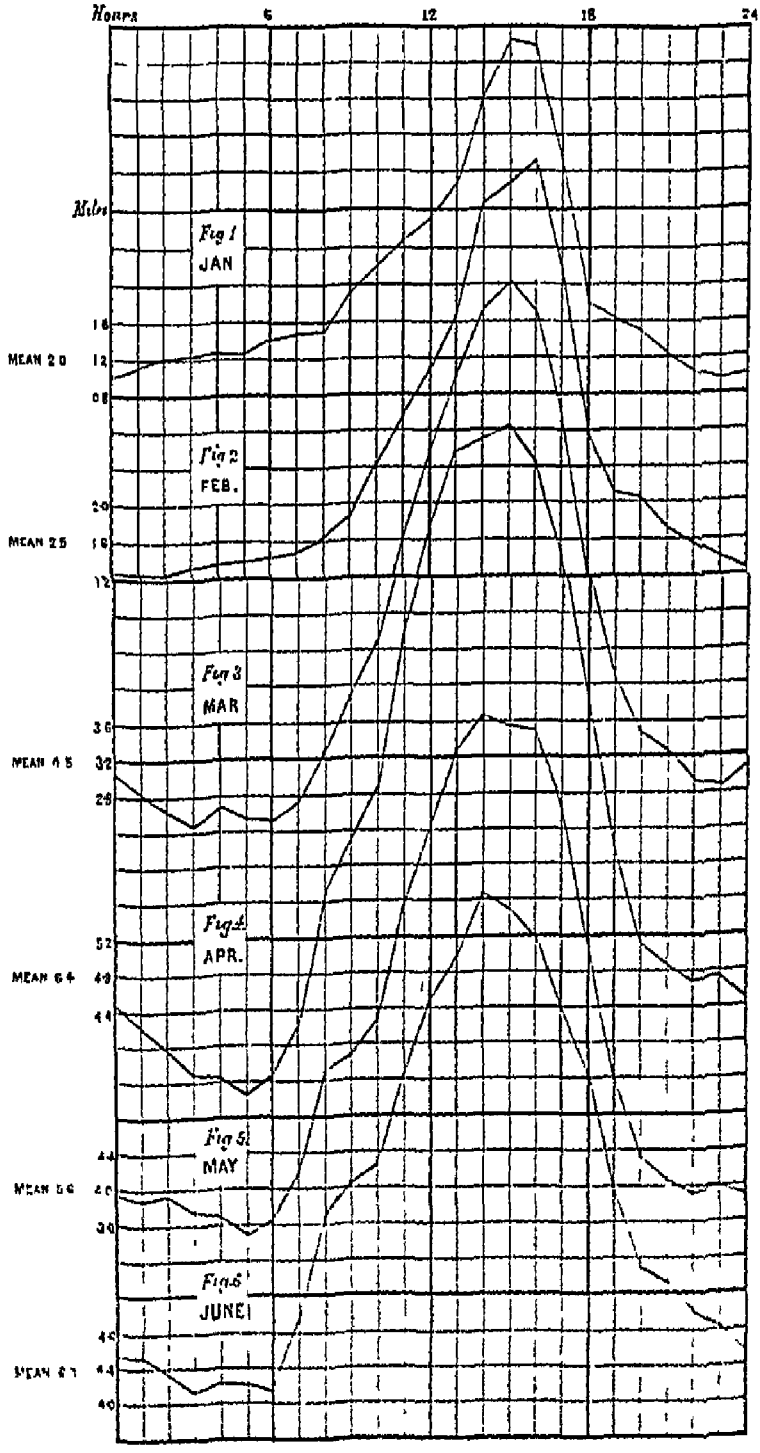
MEAN DIURNAL VARIATION OF THE WIND AT CHITTAGONG IN SEPTEMBER, OCTOBER, NOVEMBER AND DECEMBER, SHOWING THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS.



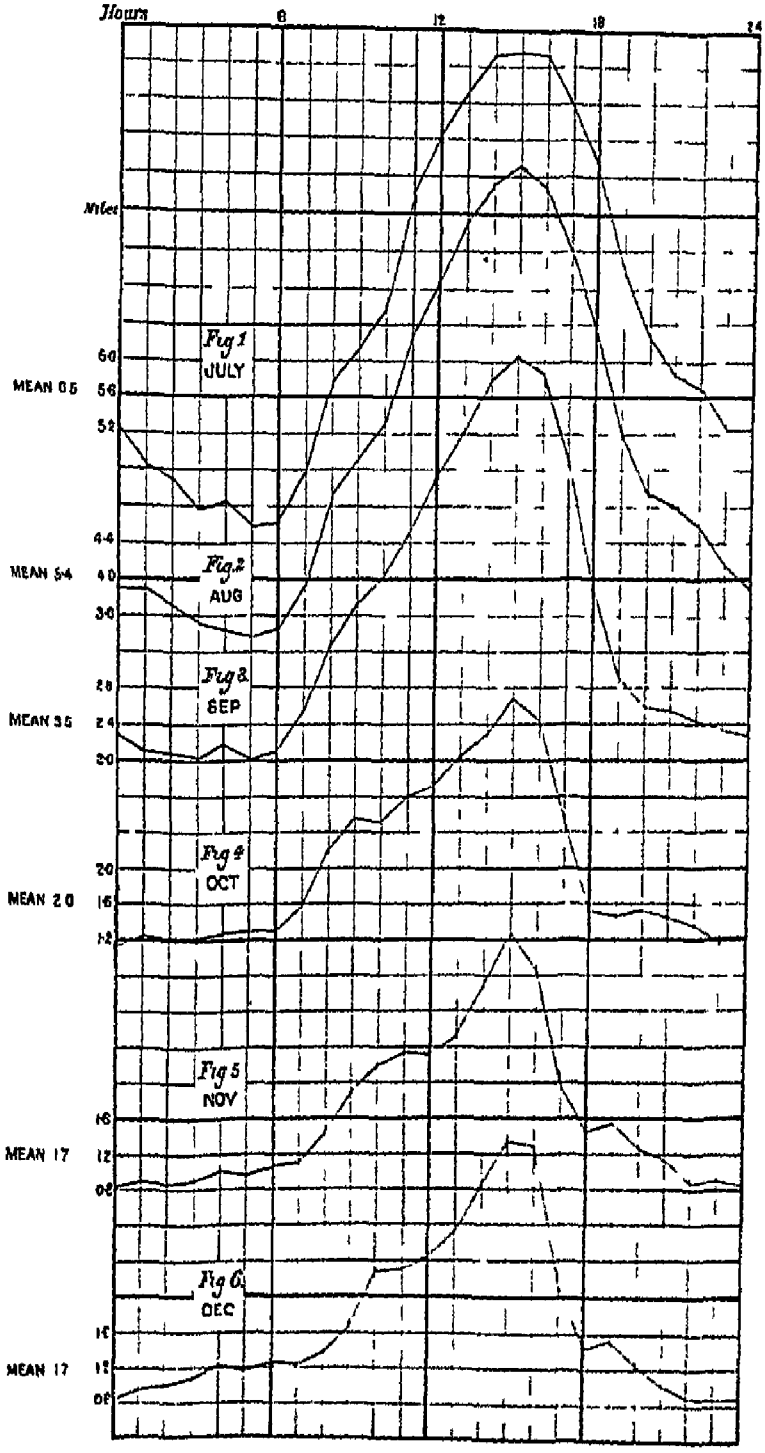
MEAN DIURNAL VARIATION OF THE WIND AT CHITTAGONG IN PERIODS OCTOBER TO FEBRUARY AND MARCH TO SEPTEMBER SHOWING THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS.



MEAN DIURNAL VARIATION OF THE WIND VELOCITY AT CHITTAGONG FOR THE MONTHS JANUARY TO JUNE, SHOWING THE TOTAL AIR MOVEMENT IRRESPECTIVE OF DIRECTION DURING SUCCESSIVE HOURS.



MEAN DIURNAL VARIATION OF THE WIND VELOCITY AT CHITTAGONG FOR THE MONTHS JULY TO DECEMBER, SHOWING THE TOTAL AIR MOVEMENT IRRESPECTIVE OF DIRECTION DURING SUCCESSIVE HOURS



DIURNAL VARIATION OF NORTH-SOUTH AND EAST-WEST COMPONENTS OF THE RESULTANT AIR MOVEMENT DURING SUCCESSIVE HOURS AT CHITTAGONG FOR THE MONTHS APRIL, JULY, DECEMBER AND JANUARY.